



IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LONDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

CONDUCTED BY

SIR A. SMITH WOODWARD, LL.D., F.R.S., F.G.S.,
SIR GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.,
C. TATE REGAN, M.A., D.Sc., F.R.S.,

AND

W. T. CALMAN, C.B., D.Sc., F.R.S.

~~~~~  
VOL. XVII.—TENTH SERIES.  
~~~~~

30571



IARI

LONDON:

PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS,

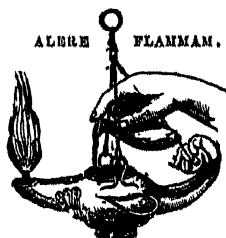
1936.

“ Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper astimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—LINNÆUS.

“ Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations.”—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forns minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



CONTENTS OF VOL. XVII.

[TENTH SERIES.]

NUMBER 97.

	Page
I. The Controlling Effect of Environment upon the Corallum in <i>Favosites</i> ; with a Revision of some Massive Species on this Basis. By O. A. JONES, M.Sc. (Cambridge and Queensland), F.G.S. (Plate I.-III.)	1
II. Descriptions and Records of Bees.—CLII. By T. D. A. COCKWRELL, University of Colorado	24
III. New and little-known African Bees of the Subfamily <i>Anthidiinae</i> (Apoidea).—Part I. By G. A. MAVROMOUSTAKIS, Limassol, Cyprus	31
IV. New Species of <i>Lasiocampidae</i> from Neotropical Countries. By W. SCHAUS	47
V. A Collection of Reptiles and Amphibians from the Mountains of British New Guinea. By H. W. PARKER, B.A., Department of Zoology, British Museum (Natural History)	66
VI. Ueber die von Miss Cheesman auf den Neu-Hebriden gesammelten Brenthiden (Coleoptera). Von R. KLEIN, Stettin ..	93
VII. A new species of <i>Mecidea</i> (Heteroptera, <i>Pentatomidae</i>) from Arabia. By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History)	95
VIII. Weitere Beiträge zur Kenntnis der parasitären Raupenfliegen (<i>Tachinidae</i> = <i>Larvævoridae</i>) von den Salomonen und Neubritannien. Von N. BARANOV (Entomologe des Institutes für Hygiene in Zagreb, Jugoslawien)	97
IX. The African Species of <i>Teleusinae</i> (Hym., Proctotrupoiden, Fam. <i>Scelionidae</i>). By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History)	114
X. Notes on Sponges from South Africa, with Descriptions of new Species. By MAURICE BURTON, M.Sc., Department of Zoology, British Museum (Natural History)	141

	Page
XI. A new Species of <i>Euphæa</i> (Odonata). By D. E. KIMMINS, Department of Entomology, British Museum (Natural History) . . .	147
XII. The Beetles belonging to the Lamellicorn Genus <i>Chiron</i> . By GILBERT J. ARROW, British Museum (Natural History)	150
XIII. Two new African <i>Hemerobiidæ</i> (Neuroptera). By D. E. KIMMINS, Department of Entomology, British Museum (Natural History)	153
XIV. The Dates of Publication of "O. H. Küster and W. Kobelt's Monograph of <i>Spondylus</i> und <i>Pecten</i> " in Volume 7, part 2, of the 'Systematisches Conchylien-Cabinet.' By LEO GEORGE HERFELIN, Ph.D., Department of Paleontology of the California Academy of Sciences	158
<i>New Book</i> :—A Manual of the common Invertebrate Animals exclusive of Insects. By H. S. PRATT	160

NUMBER 98.

XV. The African Species of <i>Teleasince</i> (Hym., Proctotrupoidea, Fam. <i>Scelionidæ</i>). By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History)	161
XVI. New Species of <i>Lasiocampidæ</i> from Neotropical Countries. By W. SCHAUS	192
XVII. Notes on Protura.—I. By RICHARD S. BAGNALL, D.Sc., F.R.S.E.	210
XVIII. On a Fossiliferous Upper Triassic Shale from Pahang, Federated Malay States. By L. R. COX, M.A., F.G.S., Department of Geology, British Museum (Natural History). (Plate IV.)	213
XIX. On the Liassic Brachiopod Genera <i>Orthoidra</i> and <i>Orthotoma</i> . By HELEN M. MUIR-WOOD, D.Sc., F.G.S. From the Department of Geology, British Museum (Natural History)	221
XX. Insects of the New Hebrides: <i>Chrysomelidæ</i> . By G. E. BRYANT, F.R.E.S.	242
XXI. On the Dates of Publication of Motschulsky (V. de), 'Études entomologiques,' I.—XI., 1853–1862. By FRANCIS J. GRIFFIN, A.I.A., Registrar, Royal Entomological Society of London	256
XXII. Some Parasitic Worms from the British Cameroons. By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	257
XXIII. Notes on <i>Cecidomyidæ</i> .—II. By H. F. BARNES, M.A., Ph.D. (Entomology Department, Rothamsted Experimental Station).	272
XXIV. A Mechanical Investigation into the Effectual Action of the Caudal Fin of some Aquatic Chordates. By A. J. GROVE, M.A., D.Sc., and GORDON E. NEWELL, B.Sc., Department of Zoology, Queen Mary College, University of London	280

	Page
XXV. On a remarkable Cladoceran. By FOLKE BORG, D.Sc., Zoological Institute, University of Upsala, Sweden. (Plate V.) ..	290
XXVI. On <i>Tomognathus</i> , a Teleostean Fish from the English Chalk. By Sir ARTHUR SMITH WOODWARD, F.R.S. (Plate VI.).	304
XXVII. On a Female of <i>Troides victoriae regis</i> with Male Coloration. By Lord ROBERTSCHILD, F.R.S.	306
XXVIII. Papers on Oriental <i>Carabidae</i> .—XXIX. By H. E. ANDREWES	307
XXIX. A rare Parasite of the Family <i>Monorchidae</i> Odhner, 1911, from an Indian Freshwater Fish (<i>Ophiocephalus punctatus</i>). By HAR DAYAL SRIVASTAVA, M.Sc., Lady Tata Research Scholar, Zoology Department, University of Allahabad, India	319
XXX. A new Species of <i>Amblypelta</i> (Heteroptera, <i>Coreidae</i>) from the British Solomon Islands. By R. J. A. W. LEVER, B.Sc. Hon. (Dunelm), D.I.C. (Lond.), A.I.C.T.A. (Trinidad), F.L.S., F.R.E.S.	324
XXXI. A new Genus and Species of <i>Capsidae</i> (Heteroptera) infesting Coffee in Kenya. By W. E. CHINA, M.A., Department of Entomology, British Museum (Nat. Hist.).....	326
NUMBER 99.	
XXXII. On a Collection of <i>Lymantriidae</i> (Heterocera) from North Yunnan. By C. L. COLLENETTE, F.R.E.S. (Plate VII.).....	329
XXXIII. Descriptions and Records of Bees.—CLIII. By T. D. A. COCKERELL, University of Colorado	346
XXXIV. A new Ascarid from a Bat. By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History) .	360
XXXV. On a new Subspecies of <i>Mesembriomys hirsutus</i> from Melville Island. By R. W. HAYMAN. From the Department of Zoology, British Museum (Natural History)	366
XXXVI. New Records and new Species of Elaterid Beetles from Melanesia.—II. By R. H. VAN ZWALUWENBURG, Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, T.H. ..	368
XXXVII. Notes on the Natural History of certain Sand-dwelling Cumacea. By G. E. H. FOXON, M.A., F.L.S. (From the Department of Zoology, University of Glasgow, and the Marine Station, Millport)	377
XXXVIII. Undescribed Mossmites from Mauritius. By ARTHUR PAUL JACOT, Appalachian Forest Experiment Station, Asheville, N. Car.....	398
XXXIX. The Javan Race of Oriental Yellow-throated Marten, <i>Lamprogale flavigula</i> . By R. I. Pocock, F.R.S. From the Department of Zoology, British Museum (Natural History)	403

	Page
XL. The Roe-Deer of European Turkey. By EDGAR N. BARCLAY. From the Department of Zoology, British Museum (Natural History)	401
XLI. The Ova and Larvæ of <i>Mugil capito</i> Cuv. from Lake Qarun, Egypt. By R. S. WIMPENNY, M.Sc., Fisheries Laboratory, Lowestoft	405

NUMBER 100.

XLII. New Species of <i>Atenius</i> allied to <i>A. cribrithorax</i> Bates (Coleoptera, <i>Scarabæidae</i>). By HOWARD E. HINTON, B.Sc., F.R.E.S. (Zoological Laboratory, Cambridge)	413
XLIII. New African Trichoptera.—I. By MARTIN E. MOSELY, F.R.E.S.	420
XLIV. The Arctic Species of <i>Molpadia</i> (Holothuroidea), and some Remarks on Heding's Attempt to subdivide the Genus. By ELISABETH DRICHMANN, Museum of Comparative Zoology, Harvard College, Cambridge, Massachusetts	452
XLV. Mammals from Angola, including a new Species of <i>Claviglis</i> and a new Race of <i>Zelotomys</i> . By JANE ST. LEGER, F.Z.S. From the Department of Zoology, British Museum (Natural History)....	461
XLVI. <i>Lepiceridae</i> —a new Name for the <i>Cyathoceridae</i> . <i>Lepicerinus</i> —a new Name for the Scolytid Genus <i>Lepicerus</i> Eichh. (Coleoptera). By HOWARD EVEREST HINTON (Zoological Laboratory, Cambridge)	472
XLVII. A new Species of <i>Notocotylus</i> [Trematoda] from the Water-Rail. By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	474
XLVIII. Descriptions and Records of Bees.—CLIV. By T. D. A. COCKRELL, University of Colorado	477
XLIX. New Species and Subspecies of <i>Zygænosia</i> . By Lord ROTHCHILD, F.R.S.	483
L. New Species of <i>Chionama</i> , <i>Asura</i> , and <i>Miltochrista</i> . By Lord ROTHCHILD, F.R.S.	485
LI. A new Fish of the Genus <i>Olupea</i> from Chile. By J. R. NORMAN, Department of Zoology, British Museum (Natural History)	491

NUMBER 101.

LII. Thysanoptera from Africa. By DUDLEY MOULTON, Redwood City, California	493
LIII. The <i>Disparoneura</i> -complex: Generic Characters and Lists of Species (Odonata). By J. COWLEY, F.R.E.S.	500
LIV. The First Genus and Species of <i>Helotrephida</i> (Homiptera) from the New World. By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History)	527
LV. On a small Collection of <i>Tridactylidae</i> and <i>Gryllidae</i> from Anglo-Egyptian Sudan made by Mr. H. B. Johnston. By L. CHOPARD	539

	Page
LVI. The Hypopial Stage of <i>Aleurobius farinæ</i> Koch (<i>Tyroglyphidae</i>). By S. G. JARY, B.A., Entomologist, S.E. Agric. Coll., Wye, Kent	546
LVII. House Mice (<i>Mus musculus</i>) in a Coal-mine in Ayrshire. By CHARLES ELTON (Bureau of Animal Population, Department of Zoology and Comparative Anatomy, Oxford University)	553
LVIII. New Parasitic Hymenoptera from Africa (Proctotrupoidea, Subfam. <i>Telenominae</i>). By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History)....	558
LIX. On <i>Psoliticumis</i> Heding and its Allies. By HUBERT LYMAN CLARK and ELIZABETH REICHMANN	564
LX. New Species of <i>Nusalala</i> (Neuroptera, <i>Hemerobiidae</i>). By D. E. KIMMINS, Department of Entomology, British Museum (Natural History)	568

NUMBER 102.

LXI. The Hemiptera of Christmas Island. By R. J. IZZARD, Department of Entomology, British Museum (Nat. Hist.)	577
LXII. New and little-known African Bees of the Subfamily <i>Anthidiinae</i> (Apoidea).—Part II. By G. A. MAVROMOUSTAKIS, Limassol, Cyprus	600
LXIII. The Nematode Genus <i>Rondonia</i> Travassos. By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	606
LXIV. On some Collembola from Lapland. By JAMES MEIKLE BROWN, B.Sc., F.L.S., F.R.E.S.	610
LXV. On the Rate of Growth of <i>Sacculina carcini</i> Thompson in <i>Carcinus maenas</i> (Pennant). By J. H. ORTON, D.Sc.	617
LXVI. Neue Borkenkäfer (<i>Scolytidae</i> , Col.) aus Indien. Von HANS EGGERS, Stolberg (Harz)	626
LXVII. New and little-known Fossil Mammals from the Pleistocene of Kenya Colony and Tanganyika Territory.—I. By A. TINDELL HOPWOOD, D.Sc. F.L.S., Department of Geology, British Museum (Natural History)	636
LXVIII. On a new Ammonite Genus (<i>Sphenarmites</i>) from the Lias of Baluchistan. By L. F. SPATH, D.Sc., F.G.S.	641
LXIX. Note on the Habitat of <i>Neotrephes usingeri</i> China (Hemiptera, <i>Helotrephidae</i>). By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History)	645
LXX. Eine neue Calliphorine-Art (Dipt.), die Termiten angreift. Von N. BARANOV, Entomologe des Institutes für Hygiene in Zagreb, Jugoslavien	646
Index	652

PLATES IN VOL. XVII.

- PLATE I. *Favosites gothlandicus* Lamarck.
 II. *Favosites asper* d'Orb., *F. goldfussi* d'Orb., *F. basalticus* (Goldfuss), and *Angopora hisingeri*, gen. et sp. n.
 III. *Angopora hisingeri*, gen. et sp. n.
 IV. Triassic *Lamellibranchia* from Pahang (F.M.S.).
 V. *Anchistropus emarginatus* G. O. Sars.
 VI. *Tomognathus mordax*.
 VII. New *Lymantriidæ* from Yunnan.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

" perlitora spargite muscum,
 Naiades, et circum vitæcos considite fontes.
 Pollice virgineo tenebras hic carpitis flores.
 Floribus et pictum divæ replete canistrum.
 At vos, o Nymphae Craterides, ite sub undas
 Ite, recurvato variata corallia trunco
 Vellite muscosos e rupibus, et mihi conchas
 Ferte, Deæ pelagi, et pingui conchylia succo."
N. Partheni Giannettasi, Ecl. 1.

No. 97. JANUARY 1936.

I.—*The Controlling Effect of Environment upon the Corallum in Favosites; with a Revision of some Massive Species on this Basis.* By O. A. JONES, M.Sc. (Cambridge and Queensland), F.G.S.

[Plates I.—III.]

DESCRIPTIONS and figures of many of the species of the Tabulate Coral *Favosites*, established by the older writers, are found to be inadequate for present requirements, and have frequently been misinterpreted by later workers. A revision of the species is therefore much needed. This paper gives the results of an investigation into the effect of environment on the corallum of *Favosites forbesi* Edwards & Haime, and attempts a revision of some of the other species of *Favosites* on that basis. Only massive forms of Silurian and Devonian age that have been described upon European material are here considered, and the interpretation of species has been based in all cases upon topotypes, and wherever possible upon actual type-specimens. The species reviewed are:—(Silurian) *Favosites gothlandicus* Lamarck, *F. multiporus* Lonsdale, *Ann. & Mag. N. Hist. Ser. 10. Vol. xvii.* 1

F. forbesi Edwards & Haime, *F. maximus* Quenstedt, *F. asper* Edwards & Haime, and *F. hisingeri* Edwards & Haime: (Devonian) *F. goldfussi* d'Orbigny, *F. forbesi* var. *eifelensis* Nicholson, and *F. basalticus* (Goldfuss).

I am much indebted to Dr. Stanley Smith for advice and constructive criticism, and to Dr. H. Dighton Thomas for reading through my MS. and checking the literature. I also thank Dr. Gertrude Elles for help and advice; the late Prof. J. F. Marr, Dr. W. D. Lang, the late Dr. F. L. Kitchin, and Prof. Cloos for access to types and other specimens in the Sedgwick Museum, Cambridge, British Museum (Natural History), the Museum of Practical Geology, and the Geological Museum and Institute, Bonn; and Prof. Wanner of Bonn University for providing me with material from the Eifel. I myself collected much material in Shropshire, Gotland, the Eifel, and Belgium.

FAVOSITES Lamarck, 1816 *, p. 204.

Diagnosis.—Cerioid Tabulate Corals forming massive or ramose colonies, in which the contiguous corallites have thin or moderately thin walls, spinose or obsolete septa, and complete or mainly complete horizontal tabulæ.

Genolectotype (see Edwards & Haime, 1850, p. lx).—*F. gothlandicus* Lamarck, 1816, p. 206. Silurian, (Gotland. For critical remarks, see Smith & Gullick, 1925, p. 117.

Favosites gothlandicus Lamarck, 1816, p. 206 †.

Lamarck, who established the species upon material from Gotland in his own collection, describes it as follows:—"F. prismis solidis, hexadris, parallelis, contiguus," and adds "Les prismes petits, parallèles et réunis comme des prismes de basalte, paraissent, dans des parties cassées de leur masse, offrir des cubes anguleux, remplis de matière pierreuse, et divisés par cloisons transverses." Although these remarks alone are hardly sufficient to show precisely which form of *Favosites* Lamarck had before him when he wrote his description, nevertheless, he explicitly refers to the coral figured

* See Bibliography, p. 22

† A recent paper by Tripp (1933), published since the author's work was in manuscript, in no way affects the views put forward here.

by Linnæus, 1745, fig. xxvii*, a form with corallites of equal size, which have thin walls and apparently no septa, and which can be closely matched among Gotland specimens. Any doubt concerning the type of *Favosites gothlandicus* Lamarck can be settled by selecting as the neotype a *Favosites* with these characters. Whether the species must be restricted to such forms, or whether it may be extended to include forms with septa and with unequally developed corallites, is another matter, and one I now proceed to discuss.

Whilst the specimen here chosen as the neotype of *F. gothlandicus* (see p. 8) has no septa, nevertheless, when a large quantity of topotypic material is examined it is found that *there is a complete gradation from this to other forms in which septal spines are both numerous and well developed*; these agree very closely with *Favosites multiporus* Lonsdale, 1839, p. 683. It may be remarked in passing that authors have differed considerably in their statements regarding the septa in "*F. gothlandicus*," but, in this and in other connections, it should be remembered that the name has been attached to corals of more than one period, and from America and Australia as well as from Europe. Thus Edwards and Haime, 1851, p. 233, 1855, p. 256, state that there are ten or twelve septa, but make no allusion to their spinose character; and Nicholson, 1879, p. 46, that the septa are usually obsolete, but may be represented by spines; these authors were considering both European and American specimens. Lambe, 1899, p. 3, dealing entirely with American material, remarks that "short, close set, sharply pointed septal spines project inward, with frequently a slight upward inclination"; and Etheridge, 1899, p. 162, in describing an Australian form as "*F. gothlandica*," speaks of the septa as being very conspicuous. It is not likely that Lambe's and Etheridge's forms are conspecific with the Gotland coral, but this matter lies beyond the scope of the present paper.

THE EFFECT OF ENVIRONMENT UPON THE CORALLUM.

Although when strictly interpreted upon the neotype, *F. gothlandicus* is distinguished by the uniform size of

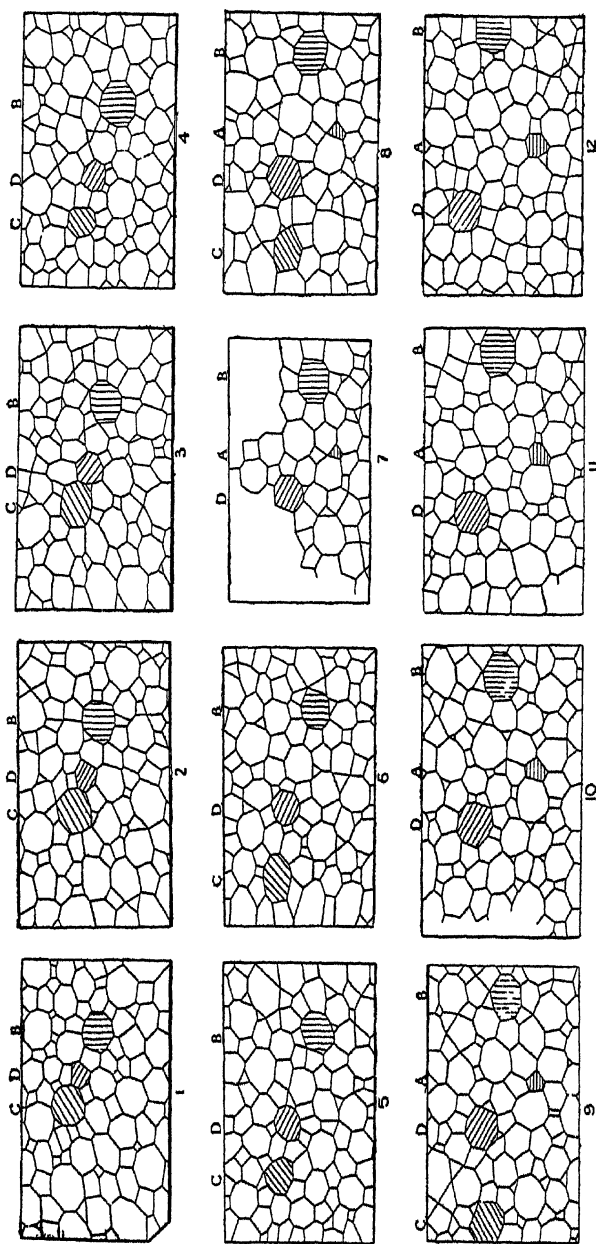
* Lamarck quoted Linnæus as referring to this figure as "*Corallum gothlandicum*." Linnæus's exact words were "specimen... corallinum gothlandicum" (1745, p. 39), i. e., a coralline specimen from Gotland. Linnæus attached no name to the figure.

the corallites, such forms are found to grade imperceptibly into others in which the corallites are markedly unequal, and which have been given specific rank under the name *Favosites forbesi* by Edwards and Haime, 1851, p. 238. As a matter of fact, the latter forms are more plentiful than the former, and, even in describing *F. gothlandicus*, Edwards and Haime, 1855, p. 256, state that the corallites are somewhat unequal in size. The character is, I believe, merely a condition of growth: both types of development can be found within the same corallum. For example, a hemispherical corallum of *F. gothlandicus* from Gotland, which on its free surface showed regularly equal corallites, showed considerable inequality in the size of its corallites when split along a plane roughly parallel to its flat base. Moreover, this variable character is not confined to the one species, but occurs in others as well. I have in my possession a large number of specimens from Australia, some of which show as great and as constant a difference in corallite diameter as "*F. forbesi*," but which nevertheless cannot be referred to that species. If, as it would seem, gemmation is not excessive and the upward growth of the corallites keeps pace with the intercalation of buds, the result is a corallum with corallites of almost equal size. If, on the other hand, the development of buds is very vigorous, these have no room to expand and the young corallites may remain small throughout, and by their mutual pressure may even cause the older and larger individuals to decrease in diameter. Large corallites surrounded by a large number of small ones have naturally a polygonal or even almost circular outline.

I have followed out the changes * in size and position of four corallites (A, B, C, D) in a typical colony of "*F. forbesi*" through a distance of 24 mm., and the result is shown in text-figures 1-12 †.

* Although Girty, 1895, and Boeher, 1893^{1,2} have both discussed reproduction and development in *Favosites*, neither of them considered the matter here discussed.

† The block of coral 36 mm. long and with a face 13 by 10 mm. was cut from the middle of a colony of "*F. forbesi*" from Dudley. The surface was polished and etched with weak hydrochloric acid, and white powder was rubbed into the incised structures in order to give the necessary contrast when photographing. The coral was rubbed down and the process repeated about every two millimetres.



Text-figs. 1-12.—*Favosites gothlandicus* Lamarck forma *forbesi* Ed. & H. $\times 2$ approx.

The drawings were made from a series of photomicrographs of polished surfaces of a coral from the Wenlock Limestone, Dudley, Worcestershire, at the following distances from the base of the corallum :—

	mm.	mm.	mm.	mm.	mm.
1.....	12.5	3.....	17.5	5.....	25.5
2.....	14.5	4.....	19.5	6.....	23.5
				7.....	28.0
				8.....	30.0
				9.....	32.0
				10.....	34.0
				11.....	36.0
				12.....	

The corallites referred to in the text as A, B, C, D are shaded and situated vertically below the respective letters.

Examination of the text-figures leads to the following observations :—

(1) Corallite A, which first appears in text-fig. 7, grows steadily larger—it is a young corallite.

(2) Corallite B increases in size from text-fig. 1 to text-fig. 4, but in text-fig. 5 it has become smaller, being cramped by young corallites. From text-fig. 5 onwards it increases in size again.

(3) Corallite C behaves in a similar manner to B.

(4) Corallite D slowly increases in size throughout.

These observations show that, in a corallum in which rapid gemmation is proceeding, the corallites will be unequal in size, but that there is no difference in kind between the corallites of the different sizes; and that a corallite may be large at one stage and small at a later stage, the size depending on the rate of production of young corallites.

Thus inequality of corallites may be considered as an example of "Form environmental" as defined by Lang, 1929, pp. 429–31.

The age and form of the colony appear to bear some relation to the phenomena under discussion. I have noticed that in small, presumably young, coralla the corallites are usually strikingly unequal, whilst in globular masses they are prone to greater inequality than in the pyriform or irregular ones.

These considerations lead to the conclusion that neither the absence of septal spines nor the uniformity in the size of the corallites can alone be taken as a specific character in *F. gothlandicus*, and that the forms described by Lonsdale as *F. multiporus* and by Edwards and Haime as *F. forbesi* must be merged with Lamarek's species.

The question whether those "species" are mutations, varieties, or merely "formæ" * must now be considered.

The facts to be borne in mind are the following :—

(1) Inequality in size of corallites is purely environmental and may appear in any species under restricted conditions of development.

* "Variety" is used as meaning an horizontal variation as opposed to "mutation," which is a variation in a vertical sense. "Formæ" are variations due solely to environment in a more restricted sense.

(2) There is a steady gradation in the number of septa from "*F. gothlandicus*" through "*F. forbesi*" to "*F. multiporus*."

(3) As will be seen later a form of *F. asper* corresponding to "*F. multiporus*" occurs in the Valentian.

(4) Septa are often, in fact usually, developed to different extents in different parts of the same corallum. Sometimes they are localized in definite bands roughly parallel to the upper surface of the corallum; this is possibly due to alternation of favourable and unfavourable conditions.

(5) "*F. gothlandicus*" ranges slightly higher than "*F. forbesi*" or "*F. multiporus*."

(6) Only a comparatively few specimens from the Valentian have been examined, but these indicate that "*F. multiporus*" occurs in lower beds than "*F. gothlandicus*," while I have only seen one doubtful specimen of "*F. forbesi*."

The fact that "*F. gothlandicus*" ranges to a later horizon than either of the other two forms, and that, so far as present knowledge goes, "*F. multiporus*" is the oldest form of the three, suggests the possibility that the series may be mutations even though at many horizons they occur together. Satisfactory evidence of the range of "*F. forbesi*" is lacking at the present time, and before this possibility is finally settled much more field-work must be done, especially careful collecting to determine the relative abundance of the three forms at different horizons. It should certainly, however, be borne in mind as a point for future work to decide.

The forms will therefore be provisionally regarded as "formæ." The characters by which I distinguish the three formæ of *F. gothlandicus* here proposed are based on development of the septa and thickness of the wall. Uniformity or want of uniformity in the size of the corallites is ignored, although those of *F. forbesi* are usually marked by strong inequality. Thus:

forma *gothlandica* = forms with no, or very few, septa, and with thin walls;

forma *forbesi* = forms with some septa and thicker walls;

forma *multipora* = forms with many septa and with relatively thick walls.

Favosites gothlandicus Lamarck
forma *gothlandica* Lamarck. (Pl. I. figs. 1-4.)

Favosites gothlandica Lamarck, 1816, vol. ii. p. 206; Smith & Gullick, 1925, p. 118, pl. viii. fig. 1. (This paper gives full synonymy.)

Description *.—The corallum is variable, hemispherical, pyriform, globular, and irregular forms being common. The flat or obtusely conical base is clothed by a strongly and concentrically wrinkled epitheca, and shows a central point of attachment. Coralla may attain a foot or even more in diameter, but specimens less than 6 or 7 inches are more common. The discoidal form of the corallum of *F. gothlandicus* closely resembles those of certain species of *Heliolites* figured by Edwards and Haine, 1855, pl. lvii. fig. 6, pl. lviii. fig. 2, and pl. lix. figs. 1 a & 3.

The corallites are contiguous and consequently prismatic, but they are easily separable, unless they are cemented together by recrystallization. The corallites frequently present a fairly uniform diameter, but this is by no means invariably the case. The diameter ranges from 2.5 to 5 mm. The walls are extremely thin (about 0.03 mm.) and are perforated by pores, which, on the outside of the corallite, are surrounded by a small raised rim. The pores (between 0.25 and 0.3 mm. in diameter) are arranged in one, usually two, but sometimes three longitudinal rows on each of the five, six, or seven sides of the corallite. The pores are not uniformly spaced, but on the average they lie 1 mm. apart. Those of one row usually alternate with those of the next, although certain pores of neighbouring rows may be in the same line horizontally. Septa are normally absent, but sometimes a few feeble spines may be seen. The tabulæ are thin, complete, and usually regularly spaced, being about 1 mm. apart, three or four in a space of 3 mm.

Neotype (Pl. I. figs. 1, 2).—The specimen here chosen as neotype was collected by me from the Mulde Märgelsten (=Lower Ludlow) on the shore south of Fröjel fiskläge, west coast of Gotland, and has been placed in the Riksmuseum, Stockholm. The specimen consists of the upper part of a hemispherical corallum, about 130 mm. in diameter and 70 mm. high. It had been broken

* This description differs in only a few points from that given by Smith and Gullick, *loc. cit.*

roughly parallel to the base, and thus the underside is a fractured surface. It has been further split into four parts, from two of which thin sections have been prepared, but the pieces have been cemented together again. Marginally the distal surface is obscured by matrix (in which can be seen the head of a *Calymene* and part of a lamellibranch), but otherwise the calices are clearly exposed, and show a uniform diameter, an angular outline, and thin walls. On the fractured under-surface large seven- or eight-sided corallites surrounded by smaller ones are to be seen.

Horizontal Section.—The corallites have thin walls and a uniform diameter of 3 mm. Most of these have five or six sides, but some have seven or eight, whilst a few show only three or four. There is no trace of septa.

Longitudinal Sections (three, one of which is slightly oblique).—These also show no septa; the tabulæ are complete, thin, and regularly spaced at intervals of 1 to 1.5 mm.

Horizons and Localities.—Gotland: Mulde Märgelsten (=Lower Ludlow); shore south of Fröjel fiskläge, and Tegelbruket near Klintehamn, west coast. Slite gruppen (=top of Wenlock); Island of Stora Carlsö, off the west coast. Övre Visby Märgelsten (=bottom of Wenlock); Kopparsvik south of Visby; and Gustavsvik, north of Visby. England: Wenlock Limestone; Farley (near Much Wenlock) and Wenlock Edge. Aymestry Limestone; Aymestry.

Favosites gothlandicus Lamarck forma *forbesi*

Edwards & Haime. (Pl. I. figs. 5–7.)

- ? *Millepora subrotunda*, *poris contiguis, angulatis, farcitis, subtus sulcata* Linnaeus, 1745, p. 31, fig. xvii. (Linnaeus's figure is undoubtedly that of a species of *Favosites*, but it is not possible to identify it with certainty with any one definite species. Edwards and Haime, with some doubt, referred it to their *Favosites forbesi*, and Lindström accepted their identification.)
- ? *Calamopora busaltica* (partim) Goldfuss, 1826, p. 78, pl. xxvi. fig. 4b (non 4a, 4c, 4d). (This specimen was missing from among Goldfuss's types examined in Bonn.)
- ? *Calamopora gothlandica* Goldfuss; Hisinger, 1837, p. 96, pl. xxvii. fig. 4. (Dr. S. Smith has not been able to identify the figure with any specimen in Hisinger's collection, although this includes *Favosites gothlandicus* forma *forbesi* among other species of the genus.)
- Favosites gothlandica* Lamarck (partim); Lonsdale, 1839, p. 682, pl. xv. bis, fig. 4, not necessarily figs. 3, 3a. This includes *F. gothlandicus* Lamarck forma *gothlandica* Lamarck, *F. gothlandicus*

Lamarck forma *forbesi* Edwards & Haimo, and possibly other species of *Favosites*.

Favosites forbesi Edwards & Haimo, 1851, pp. 238 9; 1855, pp. 258 9, pl. lx. figs. 2, 2 a-e, 2 g (excluding fig. 2 f).

Favosites forbesi Edwards & Haimo; Nicholson, 1879, p. 56, pl. i. fig. 7; pl. ii. figs. 1, 1 a b (excluding varieties).

Favosites forbesi Edwards & Haimo; Lindström, 1896, pp. 637, 640.

Syntypes.—Edwards and Haimo's material included specimens in the Geological Society's collection, in the Museums of Practical Geology, of Bristol, and of Paris, and in the Fletcher and Bowerbank Collections (which are now in the Sedgwick and British Museums, respectively), from the Upper Llandovery at Daniel's Wood, Tortworth, Gloucestershire: from the Wenlock Limestone of Wren's Nest, Dudley, of Benthall Edge and Much Wenlock, Shropshire, and of Falsfield, near Tortworth, Gloucestershire: and from the Silurian of Sweden.

Lectotype (here chosen).—The coral from the Wenlock Limestone, Wren's Nest, Dudley, figured by Lonsdale, 1839, pl. xv. *bis*, fig. 4, and probably by Edwards and Haimo, 1855, pl. lx. fig. 2 d. Museum of Practical Geology (Geol. Soc. Coll. 6559). Edwards and Haimo's figure is that of part of the distal surface. It agrees well with the specimen, although it is not possible to identify it with any particular portion; the locality and the collection they mention leave little doubt as to the figure being that of Lonsdale's specimen.

Description.—The corallum varies in form; the globular, often almost spherical colony is perhaps the most typical; but hemispherical, pyriform, discoidal, and irregularly shaped coralla are also common. The basal epitheca, as in forma *gothlandica*, is strong and concentrically wrinkled, the base showing a central point of attachment. The globular colonies are mostly 40 to 100 mm. in diameter, but that of the pyriform and hemispherical coralla may attain a foot or more. The corallites are prismatic; the diameter varies from less than 1 mm. to more than 5 mm. and the number of sides from three to six or more. The walls are moderately thin and a central "dark line" is usually visible. Septal spines are not very numerous, but reach about one-third of the distance to the centre of the corallites; frequently they are partly or completely obscured by recrystallization. The tabulæ are thin, usually horizontal and fairly evenly spaced, but vary greatly in distance apart even in the

same specimen. The mural pores are large, far apart, usually in two rows which are opposite or sub-opposite.

Remarks.—The features distinguishing this forma from the forma *gothlandica* are the presence of septa, thicker walls, and, as a rule, more tabulæ. Nevertheless, the formæ grade into one another, and the forma *forbesi* grades into the third forma *multi-pora*; thus it comes about that there are intermediate forms between the formæ which are difficult to place.

Description of Lectotype (Pl. I. figs. 5, 6) (communicated by Dr. Stanley Smith).—"The specimen is half of a hemispherical corallum 62.5 mm. high and 102.5 mm. in diameter. The base is flat, but there is a well-marked central cone of attachment; no basal epitheca is present. The distal surface is even and nearly hemispherical, but the sides are steep and the top rather flattened. The cut and polished surfaces show the corallites radiating fanwise from the middle of the surface. The calices are well preserved and displayed at the summit, but are masked by matrix and appear somewhat crushed on the sides. A transverse section has now been cut from the distal surface and a longitudinal one from the cut surface.

"*Horizontal Section.*—The large corallites range up to 2.5 mm. in diameter and are in some cases almost circular in outline; the small ones are more numerous than the large ones, but less so than the corallites of intermediate size. The corallite walls are about 1 mm. in thickness. The septa are not seen in this section.

"*Longitudinal Section.*—This section reveals the presence of both septal spines and mural pores. The tabulæ are mostly from 1 to 1.5 mm. apart, but at the distal surface are more crowded." The specimen agrees in every detail with Edwards and Haimé's excellent description of the species, and with their figures, 1855, pl. lx. figs. 2 c, 2 d, 2 e, & 2 g.

Edwards and Haimé's figs. 2, 2 a, and 2 b show two young coralla from Dudley, in the Fletcher collection; concerning these Edwards and Haimé remark that they "present the general characters of the species but have much larger calices." These two specimens (now in the Sedgwick Museum, Cambridge) are of about the same size and are very similar to each other in all respects.

They are hemispherical, have a flat base, and measure 22 mm. in diameter and 10 mm. in height. The corallites are 3.5 to 4 mm. in diameter, with a few very small ones (0.5 to 1.5 mm. in diameter) interspersed among the larger ones. Fig. 2 is a good drawing of the specimen Sedg. Mus., a. 400, except that the corallites near the edges, which are actually rather crushed, have been restored in the figure. Fig. 2 a, which shows the under surface of the second specimen, is not so accurate. The central point of attachment is not as prominent in the specimen as in the figure, nor are the walls of the corallites so distinct. I have cut a similar but rather taller specimen from the same locality, but found no septa; these may, however, have been obscured by the highly crystalline state of the infilling calcite.

Horizons and Localities.—Gotland: Muklo Märgelsten (=Lower Ludlow); shore south of Fröjel fiskläge, and Tegelbruket near Klintehamn, west coast. Slite gruppen (=top of Wenlock); Island of Stora Karlsö. Högklint kalksten (=middle of Wenlock); Högklint, south of Visby. England: Wenlock Limestone; Dudley, Woolhope, Wenlock Edge, and Farley, near Much Wenlock.

Favosites gothlandicus Lamarek forma *multiopora*
Lonsdale. (Pl. I. figs. 8–12.)

Favosites multiopora Lonsdale, 1839, p. 683, pl. xv. *bis*, figs. 5, 5 c, not necessarily figs. 5 a, 5 b.

Favosites multiopora Lonsdale; Edwards & Haimo, 1851, p. 237; 1855, p. 258, pl. lx. fig. 4.

Favosites forbesi (partim) Edwards & Haimo, 1854, p. 258, pl. lx. fig. 2 f only.

Syntypes.—Specimens from the Coralliferous * series (=Wenlock), Marloes Bay, Pembrokeshire.

Lectotype.—Of the syntypes there is only one in the Museum of Practical Geology, and this (Geological Society's Collection 6556), which is Lonsdale's fig. 5 c, pl. xv. *bis*, is here selected as the lectotype.

Description.—The coralla, as in the other formæ of *F. gothlandicus*, differ greatly in shape, discoid, globular, and hemispherical colonies being the most common. The corallites may be uniform in size or may vary considerably, and the fully developed individuals usually attain a diameter of 2 to 3 mm. The walls, though thin, are

* See Mem. Geol. Surv. England & Wales, Sheet Mem. 227, "The Country around Milford," 1916.

perceptibly thicker than in forma *forbesi*, and the septa are numerous and well developed, being both stout and long, often almost reaching the axis of the corallite. As a rule, they are directed distally. The mural pores are of medium size, rather distant, typically in two but sometimes in three rows. The tabulæ are thinner than the walls, and are horizontal, inclined, or even curved; there are four to seven in the space of 30 mm.

Remarks.—This variety differs from forma *forbesi* in the much better development of septal spines, but the two grade into one another, and even in forma *multipora*, in fact in the same specimen, the character varies in degree.

Since, due to its crystalline condition, the lectotype shows very little internal structure, the characters of forma *multipora* have been largely interpreted upon a topotype (British Museum specimen, R. 26580, collected by Dr. Stanley Smith), which very closely approaches in appearance the coral figured by Lonsdale, 1839, pl. xv. *bis*, fig. 5. Lonsdale distinguished his species by its large number of mural pores. He remarks that the "sides are pierced by numerous pores irregularly disposed and not uniform in size . . . which in some places gives the tubes the net-work character of *Alveopora*." The specimen illustrating this—figs. 5 *a*, 5 *b*—cannot be traced, but in topotypic material I have found the pores to be arranged in rows. Both Lonsdale (1839, p. 683) and Edwards and Haime (1855, p. 258) include the lozenge-shaped section of the corallites among the specific characters, but this feature, as well as the flattened form of many of the coralla from Marloes and Wooltack Bays, is due to crushing. Lozenge-shaped corallites may be seen in one part of the coral and normal hexagonal forms in another.

Lectotype.—Specimen 6556, Geol. Soc. Coll., Museum of Practical Geology. The type, which is roughly rectangular, measures 70×55 mm. and is about 25 mm. high. One end and a small portion of the upper weathered surface have been cut and polished since it was figured, and these reveal the internal structures better than the thin sections of the specimen and confirm the presence of numerous septal spines. The distal surface displays the sections of the corallites as incised grooves defining the infilling calcite. In part, these corallites are much crushed and of lozenge shape (see Lonsdale's fig. 5 *c*);

in other places they are less distorted, but show two sides decidedly shorter than the rest, though here and there the corallites are symmetrically hexagonal, measuring 1 to 1.5 mm. in width. The mural pores are obscure.

Horizons and Localities. England: Wenlock Limestone; Marloes and Wooltack Bays, Pembrokeshire, Dudley, Worcestershire, and Wenlock Edge and Farley, near Much Wenlock, Shropshire. Gotland: Mulde Margelsten (=Lower Ludlow), Klintebergen near Klintehamn, west coast.

Although *F. gothlandicus* is typically a Salopian species, nevertheless the three formæ occur in the Valentian. In the Lower Silurian, *Favosites gothlandicus* forma *gothlandica* seems to be the most common. The specimen figured (Pl. I. figs. 3, 4) was found in the roadside exposure below Bryn Plantation near Oswestry by members of the Sedgwick Club in 1928, and has been placed in the Sedgwick Museum. Other specimens seen were from Cullimore's Quarry (in Bristol University Collection), the bank of the River Vyrnwy, 1000 yards north of Pont-ysgawrhdyd, Montgomeryshire (in the Sedgwick Museum, Cambridge), and the left bank of Morrellswood Brook, 330 yards west of Morrellswood Farm, one mile N.N.W. of Buildwas, Shropshire.

Favosites gothlandicus forma *forbesi*: I have seen only one doubtful example of this variety. It is from Golougoed, near Llandovery, and is in the Sedgwick Museum. The specimen was too recrystallized to permit definite identification.

Favosites gothlandicus forma *multipora*: a specimen in the Museum of Practical Geology, from the *Pentamerus* Limestone (Upper Llandovery) in the Stream section, 300 yards N.N.E. of Morrellswood Farm, one mile N.N.W. of Buildwas, can be referred to this forma. The corallites are somewhat larger than in most Salopian examples, though not all. It is typical in every other respect.

Favosites maximus Quenstedt.

Favosites maximus Quenstedt, 1852, p. 642, pl. lvi. figs. 4, 4 a b; 1881, p. 61, pl. cxlv. fig. 25.

Quenstedt described as "*Favosites maximus* Troost" a form * which closely resembles *F. gothlandicus* forma

* From Holmestrand.

gothlandica, but with corallites which attain a diameter of 6 to 7 mm. and which have widely spaced tabulæ. Unfortunately neither his figures nor description give any indication as to the character of the septa. The pores are arranged as in *F. gothlandicus*. A good example of Quenstedt's form is a specimen in the British Museum (Nat. Hist.), R. 24393, from the Salopian of Gotland (beach at Snäckgardet, N. of Visby). A number of specimens collected by Dr. Stanley Smith from the Coralliferous Series (=Wenlock) at Marloes and Wooltack Bays, Pembrokeshire, agree very closely with Quenstedt's figures. The corallites are between 5 and 6 mm. in diameter and have thin walls, and the tabulæ are complete, horizontal, and widely spaced, being 3 or 4 mm. apart, but the material is so recrystallized that it is not possible to arrive at any decision regarding the presence of septa or the position of mural pores. In these circumstances, it is advisable not to rename Quenstedt's form until topotypes are available, and in the meantime to refer the Marloes form to *Favosites* cf. *maximus* Quenstedt non Troost. It may well be merely a large form of *F. gothlandicus* forma *gothlandica*, since in typical specimens of that species corallites with a diameter of 5 mm. are fairly common.

Favosites asper d'Orbigny.

(Pl. II. figs. 1-3.)

Favosites alveolaris (Goldfuss); Lonsdale, 1839, p. 681, pl. xv. *bis*, figs. 1, 1 *a-b*, 2, 2 *a*.

Favosites aspera d'Orbigny, 1850, vol. i. p. 49; Edwards & Haime, 1851, p. 234; 1855, p. 257, pl. lx. figs. 3, 3 *a*.

Description.—The corallum is massive, and usually hemispherical or pyriform. The corallites are of small diameter (1 to 1.5 mm.) and have very thin walls. The septal spines, which are not very numerous, are very short and are irregularly developed. The tabulæ are thin, complete, and horizontal, and are usually opposite or sub-opposite in contiguous corallites; there are four to seven in a space of 3 millimetres, and they are usually regularly spaced in any one specimen. The mural pores are of medium size and in two rows which are usually situated at, or very close to, the angles, but are sometimes found in the corallite faces.

Remarks.—*Favosites asper* is distinguished from *F. gothlandicus* by its very short and irregularly developed septa, by its small size, and by often having the mural pores in the angles of the corallites. D'Orbigny, in founding the species, cites only Lonsdale's first figure. The specimen cannot be traced, and *F. asper* is therefore interpreted upon other material mainly from Wenlock and Dudley. The other syntype of *F. alveolaris* Lonsdale (non Goldfuss) (fig. 2) is in the Geological Society's Collection, Museum of Practical Geology, specimen 6560. Although not mentioned by d'Orbigny, it may be considered as conspecific with Lonsdale's fig. 1 and with the specimens here described, for, although the corallites are considerably larger than in the more typical forms, it agrees with them in all other respects. Edwards and Haime's figure of *F. asper* (1855, pl. lx. fig. 3) is undoubtedly that of the missing holotype. It agrees very closely with Lonsdale's fig. 1, and is described as coming from Leinthall Earls, near Ludlow. Blake (1902, pp. 11 & 18) is wrong in identifying it with Lonsdale's fig. 2, which is that of specimen G.S. 6560 and is from Wenlock, for, although Edwards and Haime state in their synonymy of *Favosites asper* (1854, p. 257) "*Favosites alveolaris* Lonsdale, in Murchison, Silur. Syst. p. 681, pl. xv. bis, fig. 2, and perhaps also the fig. 1, 1839," this should undoubtedly read "fig. 1, and perhaps also the fig. 2."

One specimen from the Valentian shows a great number of septa. It seems probable that this is a specimen of a form that is related to *F. asper* in the same way as *F. gothlandicus* forma *multiplora* is to *F. gothlandicus* forma *forbesi*. It is, however, inadvisable to create a new name for this one specimen.

Lectotype.—*Favosites alveolaris* Lonsdale, 1839, p. 681, pl. xv. bis, fig. 1, Wenlock Limestone, Leinthall Earls, near Ludlow. Since this specimen cannot be traced, the interpretation of the species is here based on British Museum specimen, R. 26558, from the Wenlock Limestone, Farley, near Much Wenlock, collected by myself. Its description is as follows:—

The hemispherical corallum is about 140 mm. in diameter and 60 mm. high. The base is flat, but the basal epitheca has perished, and the corallites are seen to radiate from the centrally situated point of attachment.

Owing to the mural pores being at the angles, the walls present a somewhat serrate appearance. The distal surface is well preserved, and some short septal spines may be detected in the small calices.

Horizons and Localities.—Wenlock: Dudley, Worcestershire; Presthope and Farley, near Much Wenlock, Shropshire; Wooltack Bay, Pembrokeshire. Lower Ludlow (Aymestry Limestone): Woolhope, Shropshire. Also from the Valentian shales near Buildwas and Skeinwood, Shropshire.

Twenhofen (1914, p. 24) made *F. asper* the type of a new genus, *Paleofavosites*, the distinguishing character of which was that the pores were invariably in the angles of the corallites. But that is by no means always the case, and there is no other feature to differentiate it from *Favosites*. *Paleofavosites* must, therefore, be regarded as a synonym of *Favosites*.

Favosites hisingeri Edwards & Haime.

Favosites hisingeri Edwards & Haime, 1851, p. 240, pl. xvii. figs. 2, 2 a-b; 1855, p. 259, pl. lxi. figs. 1, 1 a-b.

Edwards and Haime, 1851, founded *Favosites hisingeri* upon several Favositids of Silurian and also possibly Devonian age from England, Gotland, and North America. They identify the species with Linnæus's coral *Millipora poris contiguis angulatis; diaphragmatibus transversalibus plurimis*, 1745, p. 32, fig. xxi., and, in their later work, with Hall's *Astrocerium venustum*, 1852, p. 120, pl. xxxiv. fig. 1, which it may very well have included and which their early figures (1851, pl. xvii. figs. 2, 2 a) may represent (the locality of this figured coral, however, is not stated). The authors distinguish *F. hisingeri* from other species of the genus by the septa, which they state "are bent upwards and more developed than in the other Favositids"; they mention, moreover, that the walls are "rather thick."

F. hisingeri clearly includes more than one species of Favositoid corals, and in order to fix the name to one particular form I attach the name to the coral from Benthall Edge formerly in the Bouchard-Chantereaux collection and figured by Edwards and Haime in their work (1855, pl. lxi. fig. 1).

The trivial name *hisingeri* is generally used for the *Ann. & Mag. N. Hist.* Ser. 10. Vol. xvii. 2

coral with lamellar septa here described as *Angopora hisingeri*, gen. et sp. n. *Angopora hisingeri* may possibly be the coral figured by Edwards and Haime, 1851, but it is not that figured in 1855 (the coral from Benthall Edge, to which I have attached the name *Favosites hisingeri* *).

ANGOPORA, gen. nov.†

Laminopora Jones, 1930, p. 35. [The name *Laminopora* is pre-occupied.]

Diagnosis.—Tabulate corals resembling *Favosites*, but with discontinuous lamellar septa which break up into spines along their axial edges.

Genotype.—*Angopora hisingeri*, sp. n., Övre Visby Märgelsten (=Lower Wenlock), Högklint, south of Visby, Gotland.

Remarks.—*Angopora* shows some resemblance to *Fossapora* R. Etheridge fil. (1903, p. 16) and to *Laceripora* Eichwald (1860, p. 490), both of which have lamellar septa. *Fossapora* differs from *Angopora* in having only six septa and more highly perforate walls, while *Laceripora* differs in having septa which are not produced into spines, walls which are very highly perforate, and a ramose corallum. The genotype of *Astrocerium* Hall, 1852, p. 120—*A. venustum* Hall (*loc. cit.* and pl. xxxiv. fig. 1), which Edwards and Haime include in their synonymy of *Favosites hisingeri*—is a *Favosites* resembling *F. hisingeri* in size of its corallites, form of corallum, and spinose septa which are distally directed.

Angopora hisingeri, sp. n.

(Pl. II. figs. 4–7; Pl. III. figs. 1, 2.)

Probably, but not necessarily, *Favosites hisingeri*, partim, Edwards & Haime, 1851, p. 240, pl. xvii. figs. 2, 2 a–b.

Description.—The corallum is typically discoid, of irregular shape, and attains a large size but usually no great thickness, though hemispherical and pyriform colonies are also found. The underside is flat and is covered by a stout, concentrically wrinkled epitheca; whilst the distal surface, as a rule, is unevenly developed, rising into knobs and ridges. The coral is built up of

* The figured type has not been traced, and I have not sufficient material resembling it to elucidate the structure and relationships of the form.

† ἄγγος, a box or vessel (thus, a cell).

superimposed layers, which correspond to the strong annulations on the basal epitheca and thus suggest pauses in growth, followed by the formation of a new layer of coral, which overlaps irregularly the layer previously formed. The corallites, which are of fairly uniform size, have generally six sides and attain a diameter of about 1 mm.; the walls are moderately thick. The septa—about 12 in number—are very short lamellar septa, which, however, do not necessarily persist through the entire length of the corallite and, in fact, appear to be entirely absent in places. The axial edges of the lamellæ break up into long spines which reach inwards halfway, or more than halfway, towards the axes of the corallites, and which usually curve distally. The mural pores are small, rather widely spaced, and are found usually in two rows which are generally placed near the angles. The tabulæ are complete and numerous, seven to nine in a space of 3 mm.

Remarks.—The exterior aspect of this species, shown in Pl. III. figs. 1, 2, is very characteristic. The superimposed layers and the rough irregular upper surface are unusual in massive Favositidæ.

Holotype (Pl. III. figs. 1, 2).—The specimen collected by me from the Övre Visby Märgelsten at Höglint, south of Visby, Gotland (and placed in the Riksmuseum, Stockholm).

Description.—The specimen is a discoid, originally oval corallum, one end of which had been broken off. It is now 110 mm. long, 110 mm. wide, and 25 mm. high. The distal surface is uneven, displaying the nodular features and overlapping layers so characteristic of the species. The under surface shows strong ridges concentric to the point of attachment, but the epitheca has partially perished.

Localities.—Gotland; Kopparsvik and Höglint, south of Visby; Gustavsvik, north of Visby. England: Benthall Edge, Shropshire. All specimens of Wenlock age.

Favosites goldfussi d'Orbigny.

(Pl. II. figs. 8-10.)

Favosites gothlandica (partim) Goldfuss, 1826, p. 78, pl. xxvi. fig. 3 b only. [Fig. 3 a, 3 e is a Silurian form, possibly *F. gothlandicus* Lam., from the Drift, Gröningen, but 3 c and 3 d (also probably *F. gothlandicus*) are missing from Goldfuss's types.]

Favosites golfussi (partim) d'Orbigny, 1850, p. 107. (D'Orbigny cites "fig. 3" of Goldfuss.)

Favosites goldfussi Edwards & Haine (partim), 1851, p. 235, pl. xx. figs. 3, 3 a, 3 b; 1855, p. 214, pl. xlvii. figs. 3, 3 a c. (Edwards and Haine refer only to figs. 3 b and 3 c, Goldfuss.)

Favosites forbesi Edwards & Haine var. *eifelensis* H. A. Nicholson, 1879, p. 61, pl. ii. fig. 3, pl. iii. figs. 1, 1 a b. (Nicholson's types have not been traced, but his figures leave no doubt as to the identity of his form with d'Orbigny's. It may be mentioned that the lectotype of *goldfussi* d'Orbigny in Bonn University has been labelled *F. eifelensis* Nicholson.)

Lectotype.—The specimen figured by Goldfuss, 1829, pl. xxi. fig. 3 b, is here selected as lectotype.

Description.—The coralla vary very much in form and in size from small globular or pyriform colonies 20 mm. in diameter, through spherical and hemispherical colonies of large size, to very large hemispherical and mushroom-shaped masses as much as 350 mm. in diameter. The basal epitheca is strong and concentrically wrinkled, and a central point of attachment is frequently preserved. The corallites are polygonal and prismatic, and vary a little in size. The small colonies exhibit corallites from 2.5 to 3 mm. in diameter, but interspersed with these are a considerable number of younger ones with a diameter of often less than 1 mm.; in the larger coralla the younger corallites are much fewer and the diameter of the corallites is more constant—about 3 mm. The adult corallites have from five to seven or eight sides and the young ones three to five. The corallite walls are moderately thick and a central "dark line" can usually be seen. Septal spines are strong and numerous, and sometimes extend into the corallite about half its radius; the spines are blunt and have a slight upward inclination. Nicholson's pl. iii. fig. 1 b accurately illustrates the type of septa. The tabulæ are complete and thin, four or five in the space of 3 mm. The mural pores are usually in two, sometimes three, rows on each corallite face.

Remarks.—I collected in the Eifel a complete series of specimens which range from young colonies of small size to very large fully grown ones, and the thin sections which I have cut from them demonstrate that *F. forbesi* var. *eifelensis* Nich. is the young form of *F. goldfussi*. A young corallum which previously would have been designated *F. forbesi* var. *eifelensis* is illustrated on Pl. II. figs. 8, 10, and a large corallum, *F. goldfussi*, on Pl. II. fig. 9.

The species occurs in Devonshire, but some of the specimens from the Torquay district do not show the full development of septa and sometimes show none at all. These specimens are, however, not so well preserved as the Eifel material, many being "remanié" fossils from the Permian breccia. Edwards and Haime (1854, p. 260) state, concerning the Devon material, that they found septa in only two specimens, though they had examined several hundred. This is probably accounted for by the fact that they examined only polished surfaces and not thin sections.

Description of Lectotype (specimen figured by Goldfuss, pl. xxvi. fig. 3 b).—The lectotype is a small globular colony about 30 mm. long, 20 mm. wide, and 20 mm. thick, with the corallites opening to nearly all the free surface. The corallites are variable in size, ranging from 1 to 3 mm. in diameter. The specimen has not been sectioned, owing to its small size, but the long septa can be seen clearly.

Horizons and Localities.—Germany (Eifel): Calceolischichten, Middle Devonian; Auburg, Gerolstein; between Gerolstein and Gees. England: Middle Devonian; Babbacombe and Oddicombe beaches, Torquay, and (*in situ*) Mudstone Bay, Brixham, Devonshire.

Favosites basalticus (Goldfuss).
(Pl. II. figs. 11, 12.)

Calamopora basaltica (partim) Goldfuss, 1829, p. 78, pl. xxvi. figs. 4 c, 4 d (not figs. 4 a, 4 b). [The specimens represented by figs. 4 a & 4 b are missing from the Goldfuss collection—fig. 4 a, a coral from North America, was possibly a species of *Emmonsia*, and fig. 4 b, described as from Gotland, was probably *Favosites gothlandicus*.]

Non *Favosites basaltica* Lambe, 1899, p. 8, pl. i. figs. 3, 3 a. (Lambe based his conception of the species on Goldfuss's pl. xxvi. fig. 4 a, and he placed in it forms which are probably referable to *Emmonsia*.)

Lectotype.—The specimen figured by Goldfuss as figs. 4 c, 4 d is here selected as lectotype. It has not been possible to section the lectotype, the following description being based partly on it and partly on sections of a similar specimen from the Middle Devonian of Belgium.

Description.—The corallum is massive and the corallites are contiguous, prismatic, and rather small (1.5 to 2 mm. in diameter). Corallite-walls rather thick, especially

at the corners, giving the corallites a tendency to a cylindrical shape. Septa absent. Mural pores in one or, very occasionally, two rows on each corallite-face. Tabulæ complete, flat or slightly arched, not very numerous, about one per millimetre.

Horizons and Localities.—Germany: Middle Devonian; Eifel. Belgium: Middle Devonian; first quarry N.E. of the railway station at Couvin.

BIBLIOGRAPHY.

- BEECHER, C. E. 1893¹. "The Development of a Paleozoic Poriferous Coral." Trans. Connecticut Acad. vol. viii. pt. 2, pp. 207-214, pls. ix.-xiii.
- . 1893². "Symmetrical Cell Development in the Favositidae." Trans. Connecticut Acad. vol. viii. pt. 2, pp. 215-219, pls. xiv.-xv.
- BLAKE, J. F. 1902. 'List of the Types and Figured Specimens, recognized by C. D. Sherborn, F.G.S., in the Collection of the Geological Society of London.' London.
- D'ORBIGNY, A. D. 1850. 'Prodrome de Paléontologie . . .,' vol. i. Paris.
- EDWARDS, H. M., & HAIME, J. 1850. 'A Monograph of the British Fossil Corals.—Introduction.' Palaeontographical Society, London.
- & ———. 1851. "Monographie des Polypiers Fossiles des Terrains Paléozoïques . . ." Arch. Mus. d'Hist. Nat. Paris, tome v. pp. 1-502, pls. i.-xx.
- & ———. 1853. 'A Monograph of the British Fossil Corals.—Pt. IV. Corals from the Devonian Formation.' Palaeontographical Society, London.
- & ———. 1855 (1854). *Ibid.*—'Pt. V. Corals from the Silurian Formation.'
- EICHWALD, C. E. VON. 1860. 'Lothæa Rossica,' i.
- ETHEERIDGE, R., Jun. 1899. "On the Corals of the Tamworth District . . ." Rec. Geol. Surv. N.S.W. vol. vi. pt. 3, pp. 151-182, pls. xvi.-xxxviii.
- . 1903. "Fossopora, a new Genus of Palaeozoic Perforate Corals." Rec. Austral. Mus. vol. v. no. 1, pp. 16-19, pls. i., ii.
- GIRTY, G. H. 1895. "The Development of the Corallum in *Favosites forbesi* var. *occidentalis*." Amer. Geol. vol. xv. pp. 131-146, pls. vii., viii.
- GOLDFUSS, G. A. 1829. 'Petrefacta Germaniæ,' Th. i. pt. 2, pp. 77-164, pls. xxvi.-l. Folio. Düsseldorf.
- HALL, J. 1852. 'Natural History of New York.—Pt. VI. Palaeontology,' vol. 2, 'Descriptions of the Organic Remains of the Lower Middle Division of the New York System.'
- HISINGER, W. 1837. 'Lethæa Suecica . . .' Stockholm.
- JONES, O. A. 1930. "A Revision of some Palaeozoic Coral Genera and Species." Abstracts of Dissertations approved for Ph.D., M.Sc., and M.Litt. Degrees in the University of Cambridge for the Academic Year 1928-1929, pp. 35-36.
- LAMARCK, J. B. P. DE. 1816. 'Histoire Naturelle des Animaux sans Vertèbres . . .,' vol. ii. Paris.
- LAMBE, L. M. 1899. "A Revision of the Genera and Species of Canadian Palaeozoic Corals." Contributions to Canadian Palaeontology, vol. iv. pt. 1, 96 pp., 5 pls. Ottawa.

- LANG, W. D. 1929. "Form in Fossils." Proc. Geol. Assoc. vol. xxxix. pt. 4 (for 1928), pp. 429-444, figs. 35-41.
- LINDSTRÖM, G. 1895. "On the 'Corallia Baltica' of Linnæus." Öfvers. Kongl. Vetén. Akad. Forhandl. Årg. lii. no. 9, pp. 615-641.
- LINNÆUS, C. 1745. "Dissertatio, Corallia Baltica adumbrans, quam . . . submittit Henricus Fougé." Upsala.
- LONSDALE, W. 1839. "Corals," in R. I. Murchison, 'The Silurian System . . .,' pp. 675-694, pls. xv., xv. bis, xvi., xvi. bis.
- NICHOLSON, H. A. 1879. "On the Structure and Affinities of the 'Tabulate Corals' of the Palæozoic Period." Edinburgh and London.
- OWEN, D. D. 1844. "Description of some Organic Remains figured in this Work, supposed to be new." 'Report of a Geological Exploration . . . Iowa, Wisconsin, and Illinois . . . in 1839,' pp. 69-86, pls. xi.-xviii. First Session, 28th Congress, Senate of U.S.A.
- QUENSTEDT, F. A. 1851-2. 'Handbuch der Petrefactenkunde,' 1st ed. Tübingen.
- . 1881. 'Petrefactenkunde Deutschlands.' Bd. vi. and Atlas. Leipzig.
- SMITH, S., & GULLICK, B. 1925. "The Genera *Favosites* and *Emmonsia* and the Species *Emmonsia parasitica* (Phillips)." Ann. & Mag. Nat. Hist. ser. 9, vol. xv. pp. 116-126, pl. viii.
- TRIPP, K. 1933. "Die Favositen Gotlands." Palæontographica, Bd. lxxix. Abth. A (3-6), pp. 75-142, pls. vii.-xvi.
- TROOST, G. 1840. "Appendix.—Organic Remains discovered in the State of Tennessee . . ." Pp. 44-47 of the Fifth Report to the 23rd General Assembly of Tennessee, made Nov. 1839, pp. 1-75. 8vo. Nashville.
- TWENHOFEL, W. H. 1914. "The Anticosti Island Faunas." Geol. Surv. Canada, Mus. Bull. no. 3 (Geol. series no. 19), pp. 39, pt. i.

EXPLANATION OF THE PLATES.

PLATE I.

All sections enlarged $4\frac{1}{2}$ times.

Favosites gothlandicus Lamarck forma *gothlandica* Lamarck.

- Fig. 1. Transverse section of neotype. Riksmuseum, Stockholm. Mulde Margelsten (=Lower Ludlow), Fröjel fiskläge, W. coast of Gotland.
- Fig. 2. Longitudinal section of the same specimen.
- Fig. 3. Transverse section. Sedgwick Mus., A. 5141 b. Valentian, roadside below Bryn Plantation, 1 mile N.W. of Llanyblodwel, Oswestry.
- Fig. 4. Longitudinal section of the same specimen. Sedgwick Mus., A. 5141 c.

Favosites gothlandicus Lamarck forma *forbesi* Ed. & H.

- Fig. 5. Transverse section of lectotype. Mus. Pract. Geol. (Geol. Soc. Coll.), no. 6559. Wenlock Limestone, Wren's Nest, Dudley.
- Fig. 6. Longitudinal section of the same specimen.
- Fig. 7. Transverse section. Brit. Mus., R. 25924 (cut from R. 25923). Salopian, Dudley.

Favosites gothlandicus Lamarck forma *multiplora* Lonsdale.

- Fig. 8. Transverse section. Brit. Mus., R. 26582 (cut from R. 26580). Coralliferous Series (=Wenlock), Wooltack Bay, Pembroke-shire.

24 *Effect of Environment upon the Corallum in Favosites.*

- Fig. 9.* Transverse section. Brit. Mus., R. 26575 (cut from R. 26574). Salopian, Dudley.
Fig. 10. Longitudinal section. Brit. Mus., R. 26578 (cut from R. 26577). Salopian, Dudley.
Fig. 11. Transverse section. Mus. Pract. Geol., no. 48702. Valentian, near Oswestry.

PLATE II.

All sections enlarged $4\frac{1}{2}$ times.

Favosites asper d'Orbigny.

- Fig. 1.* Transverse section. Brit. Mus., R. 26303 (cut from R. 26302). Salopian, Dudley.
Fig. 2. Longitudinal section. Sedgwick Mus., A. 514 + d. Salopian, Wenlock Limestone, Wenlock.
Fig. 3. Longitudinal section. Brit. Mus., R. 26561 (cut from R. 26559). Wenlock Limestone, Farley, near Much Wenlock.

Angopora hisingeri, gen. et sp. n.

- Fig. 4.* Transverse section. Brit. Mus., R. 26563 (cut from R. 26562). Salopian, Gustavsvik, Gotland.
Fig. 5. Longitudinal section of the same specimen. (Drawing.) Brit. Mus., R. 26564.
Fig. 6. Transverse section. Brit. Mus., R. 26572 (cut from R. 26571). Salopian, Hogklint, Gotland.
Fig. 7. Longitudinal section. (Drawing.) Brit. Mus., R. 514. Wenlock Limestone, Benthall Edge, near Much Wenlock.

Favosites goldfussi d'Orbigny.

- Fig. 8.* Longitudinal section of young specimen (*Favosites forbesi* var. *eifelensis* Nicholson). Brit. Mus., R. 26567 (cut from R. 26565). Eifelian, Calceola-schichten, Auburg, Gerolstein.
Fig. 9. Transverse section of large specimen. Brit. Mus., R. 26569 (cut from R. 26568). Same horizon and locality.
Fig. 10. Transverse section of same specimen as fig. 8. Brit. Mus., R. 26566.

Favosites basalticus (Goldfuss).

- Fig. 11.* Transverse section. Brit. Mus., R. 26556 (cut from R. 26555). Eifelian, Quarry N.E. of station, Convin, Belgium.
Fig. 12. Longitudinal section of the same specimen. Brit. Mus., R. 26557.

PLATE III.

All figures natural size.

Angopora hisingeri, gen. et sp. n. Holotype. Riksmuseurn, Stockholm. Salopian, Övre Visby Märgelsten, Hogklint, Gotland.

- Fig. 1.* Distal surface.
Fig. 2. Under surface.

II.—*Descriptions and Records of Bees.*—CLII.

By T. D. A. COCKERELL, University of Colorado.

THIS is the second paper on the bees of the second Ogilvie African Expedition. I have used the abbreviations J. O. for John Ogilvie and L. O. for Lizzie Ogilvie. The specimens will be found in the British Museum.

Gronoceras cerberus (Friese) var. *optima*, nov.

♂ (type).—Larger and more robust, apical spines of abdomen black (red in typical *G. cerberus*). Anterior wing 13 mm. long (10.3 in typical *G. cerberus*).

♀.—Larger and more robust; length 20–22 mm.

S.W. Africa: type male from Okahandja (printed Okahandya on labels), Jan. 23 (*J. O.*). Females from Otavi, Dec. 25 (*L. O.*), and Windhoek, Dec. 12 (*J. O.*).

Typical *G. cerberus* come from Okahandja in great numbers and one from Otavifontein, Dec. 30 (*J. O.*).

Whether the large variety has different habits remains to be discovered.

MESOTRICHIA Westwood.

M. inconstans (Smith). Otjiwarongo, Jan. 11, both sexes (*J. O.*); Otavi, ♀ (*J. O.*).

M. mossambica (Gribodo). Females from Windhoek (*L. O.*, *J. O.*); Omaruru (*L. O.*); Otavi (*L. O.*); Usakos, Jan. 16 (*L. O.*); Otavifontein (*L. O.*); Okahandja (*J. O.*, *L. O.*). Also one from Groot Fontein (*J. N. Justice*).

M. caffra (L.). Lion's Head, Cape Town, Oct. 29, ♂ (*L. O.*, *J. O.*); Beaufort West (*J. O.*, *L. O.*); Nels Poort, Dec. 4 (*J. O.*); Bot River, both sexes, Nov. (*L. O.*). The females from Bot River differ by the very dark, distinctly greenish, wings. Males with more or less of a median yellow stripe on clypeus are from Windhoek, Dec. 12 (*J. O.*), and Beaufort West, Nov. 28 (*L. O.*).

M. luteola (Lep.) (*olivacea* auctt.). Upington, females, Dec. 7, Feb. 21 (*J. O.*, *L. O.*).

M. senior (Vachal) Otavi, female (*L. O.*).

M. scioensis (Gribodo) (*anicula* Vachal). Mafeking, Feb. 28, ♀ (*J. O.*); Upington, both sexes, Dec. 7 (*J. O.*). The male has white hair on face; in male *M. heterotricha* it is yellowish.

M. heterotricha Cockerell. Beaufort West, both sexes, May 1 (*J. O.*).

XYLOCOPA Latreille.

X. capitata Smith. Bot River, Nov. 12, ♀ (*J. O.*).

X. sicheli Vachal. Nels Poort, Dec. 3–4, both sexes

(*J. O.*); Beaufort West, Nov. 24–29, 8 ♀♀ (*L. O.*, *J. O.*).

- X. *rufitarsis* Lepeletier. Lion's Head, Cape Town, Oct. 29, both sexes (*J. O.*, *L. O.*); Beaufort West, Nov. 24–29, 1 ♂, 1 ♀ (*J. O.*, *L. O.*); Bot River, Nov. 10, ♀ (*L. O.*); Nels Poort, Dec. 3–4, ♀ (*J. O.*, *A. Brock*). The Beaufort West male is larger than those from Cape Town, and has a strongly carinate clypeus.

Xylocopa tarsata Smith.

There is a group of species or subspecies allied to *X. tarsata*, which have been more or less confused. The females may be separated thus:—

- | | | |
|--|----|---|
| Hair of middle legs all black | 1. | |
| Hair of middle tarsi at least mainly red | 3. | |
| 1. Abdomen more closely and finely punctured;
hind tarsi, and apical part of tibiae, with red
hair | | <i>gaullei</i> Vachal. |
| Abdomen more strongly and less densely punctured..... | 2. | |
| 2. Hair on hind tarsi and apical part of tibiae
orange-red (Windhoek, Dec. 12, <i>J. O.</i>) | | <i>tarsata</i> Smith. |
| Hair on hind tarsi and apical part of tibiae cream-
colour | | [<i>ensis</i> Strand.
<i>tarsata namuton-</i> |
| 3. Sides of abdomen with cinereous pubescence;
middle and hind tibiae and tarsi with bright
fulvous pubescence (Angola)..... | | <i>angolensis</i> Smith. |
| Sides of abdomen with black hair; middle
tibiae with black hair | 4. | |
| 4. Anterior wings with the basal half hyaline
(as in <i>angolensis</i>), the apical half typically
golden green, but variable | | <i>wellmani</i> Ckll. |
| Anterior wings with the basal half not, or not
evidently, hyaline, the wings rich purple | 5. | |
| 5. Abdomen more closely and finely punctured
(as in <i>gaullei</i>)..... | | <i>tenkeana</i> Ckll. |
| Abdomen more coarsely and sparsely punctured. | | <i>tarsata oblita</i> ,
subsp. n. |

- X. *tarsata namutonensis* Strand was described from Namutoni, S.W. Africa. From the Ogilvie Expedition we have two from Otjiwarongo, Jan. 11 (*L. O.*), and one from Otavi, Jan. 5 (*J. O.*).

- X. *tarsata oblita* comes from Wonderboom, near Pretoria, Transvaal, Oct. 1931 (*W. P. Cockerell*), which is the type-locality, and Nels Poort, Cape Province, 3260 ft. alt., Dec. 4, 1933 (*L. Ogilvie*, *A. Brock*). It is 15–16 mm. long. It was recorded from Wonderboom as *X. tarsata*. It is conspicuously smaller and less robust than *X. t. namutonensis*.

Xylocopa sicheli gordonica, subsp. n.

♂.—Smaller, length about 17 mm., anterior wing 14.5.

Vertex with much black hair; hair of mesothorax posteriorly, and of scutellum, partly dark; hair of metathorax black, but of mesopleura light fulvous, contrasting; first tergite with thin black hair; long hairs at end of abdomen dark. The clypeus has a strong median keel.

Upington, on the Orange River, alt. 2800 ft., Dec. 7, 1933 (*J. Ogilvie*).

Related males may be separated thus :—

Hair of mesopleura entirely very dark brown; hind tibiae posteriorly with black hair, and a variable (not always evident) patch of dark red	<i>rufitarsis</i> Lep.
Upper half of mesopleura with black hair, lower half with pale yellowish; hind tibiae behind with hair all black	<i>rhodesi</i> Ckll.
Mesopleura with fulvous hair; hind tibiae behind with pale fulvous hair	1.
1. Hair of head and thorax fulvous, with a little black on vertex; long hairs at end of abdomen light red	<i>sicheli</i> Vach.
Vertex with mainly black hair; region behind wings with black hair; long hairs at end of abdomen dark	[Ckll. <i>sicheli gordonica</i>

I take occasion to note that in the same consignment from the British Museum are both sexes of *Mesotrichia aestuans* (L.) from Central Island, Lake Rudolf, and a female from near mouth of Kallilokwell River, L. Rudolf (*Dr. E. B. Worthington*, Cambridge University Expedition). Also from Central Island (same data) is a female, *Xylocopa gribodoi* Magretti. Also from mouth of Kabua River, Lake Rudolf (*Worthington*), comes *Crocisaspidia nigripes* (Friese). *Gronoceras felina* (Gerst.) was found on Central Island.

Trigona albofasciata (Friese).

Otavi, Jan. 5 (*L. O.*); Otavifontein, Dec. 25 (*L. O.*).

In some specimens the broad white band on second tergite is broadly interrupted in middle.

Meganomia binghami (Cockerell).

S.W. Africa: Seeheim, Feb. 16–19, both sexes, the female with abdomen red banded with yellow; Otjiwarongo, Jan. 11 (*L. O.*).

The Seeheim female (*L. O.*) represents the typical coloration. Those from Beit Bridge, S. Rhodesia (*A. Mackie*), have the abdomen black, banded with yellow, and the spots on posterior face of metathorax may be entirely absent. Perhaps two subspecies should be recognized, but the insect is very variable.

Habropoda festiva Dours.

Cape Province : Belmont, 3987 ft., Feb. 23, 2 ♀♀ (*J. O.*).

A characteristic feature, mentioned by Dours, is the little spot of white hair in middle of fifth tergite.

Osmia mediorufa Cockerell.

Orange Free State : North Bank Halt, Norvals Pont, April 16 (*L. O.*), ♀. The altitude is 3988 ft.

Megachile fimbriata Smith.

S.W. Africa : Okahandja, Jan. 25, ♀ (*J. O.*).

Anthidium odonturum Cockerell.

Cape Province : Nels Poort, Dec. 2-3 (*J. O.*).

Both sexes. The female is new. It is smaller (length about 7.5 mm.), coloured and marked as in the male ; ventral scopa pale red, white at sides ; last tergite with two large yellowish-white spots, separated by a black mark.

Macrogalea candida otaviensis, subsp. n.

♀.—Clypeus entirely black.

S.W. Africa : Otavi, Dec. 25, 1933 (*L. Ogilvie*).

The typical form is East African.

Epeolus amabilis Gerstaecker.

Cape Province : Bot River, Nov. 7 (*L. O.*).

Two, one much larger than the other, but apparently the same species.

Meliturgula minima Friese.

S.W. Africa : "Gobasis" (doubtless Gobabis), Dec. 17 (*L. O.*).

A female, with the clypeus black, except for a slender crescentic mark along upper edge, and a cream-coloured mark on each side below. As this is from the same

general region as the type male, I assume it is the female of that form. The race *perpallida* Ckll. (Beit Bridge, A. Mackie) has a broader head, and the clypeus cream-colour with two black dots. The race *pallidior* Ckll. (Sawmills, S. Rhodesia, Arnold) has a large black mark in middle of clypeus, below the level of the dots.

Hesperapis aliciae (Cockerell).

Cape Province : Nels Poort, Dec. 4, ♀ (*J. O.*) : Beaufort West, Nov. 28, 1 ♂ (*J. O.*).

Hesperapis aurescens (Cockerell).

Cape Province : Beaufort West, Nov. 25-29, 8 ♀♀, 4 ♂♂ (*J. O.*, *L. O.*).

With this long series, the separation from *H. turneri* Ckll. becomes difficult, and it may be that they are races of one species. The female has the scanty hair of thorax above hardly or slightly reddish, and runs to *H. turneri* in my table in *Ann. & Mag. Nat. Hist.*, April 1934, p. 448. The six-spined spur of middle tibia agrees. So far as I can now see, there are no valid characters to distinguish the female from *H. turneri*.

Pæcilomelitta flavida Friese.

S.W. Africa : Okahandja, Jan. 22-24, 2 ♀♀ (*J. O.*) ; "Gobasis, Okahoa Farm," Dec. 16, 2 ♀♀ (*J. O.*).

In addition to these, 13 females were taken by R. E. Turner at Okahandja in February 1928. Friese had two females from Grootfontein. In January and February 1928, Turner took at Okahandja three males which appear to belong to this species, though they are very different from the females. The male is about 5.5 mm. long, with very large and prominent eyes, the inner orbits strongly curved, so that the face is narrowed in middle ; face with very long white hair ; face-markings very pale yellowish, consisting of a stripe on mandibles, stripe on labrum, the whole of the very broad clypeus (shaped like a low broad hat), large supraclypeal mark, and narrow stripe along inner orbits (but the shining convex cheeks entirely black) ; scape slender, light yellow in front ; flagellum clavate, black at extreme base, but otherwise pale orange ; thorax black, shining, with long white hairs ; wings hyaline, with pale nervures, basal nervure falling considerably short of nervulus ; legs black,

with knees, apex of tibiæ, anterior tibiæ in front, and the tarsi light yellow; abdomen black, with margins of second and third tergites narrowly pallid.

This remarkable genus seems undoubtedly to be related to the American Panurgidæ. The male is very similar to that of the North American *Calliopsis*; the markings of the female thorax are like those of South American *Camptopœum*. The wings differ in having three cubital cells. There is also, as Friese points out, considerable resemblance to the Palæarctic genus *Epimethea*.

There are in America two Panurgid genera, *Psænythia* and *Protandrena*, which have three cubital or submarginal cells. In general appearance, *Pacilomelitta* does not closely resemble these genera, and, in spite of the venation, it would seem unnatural to associate it with them in the same immediate group. *Pacilomelitta*, with its short dagger-like tongue, and three cubital cells, seems to be the most primitive Panurgid known, and could be thought of as ancestral to some of the American genera. That it should live in South Africa is certainly surprising.

Scapter clarissima, sp. n.

♀.—Length about 5.5 mm., anterior wing 3.5.

Rather slender, but with a large broad head, which appears nearly free from hair, except a dull white beard along lower margin of clypeus, and appressed white hair covering cheeks; head and thorax black, the clypeus, supraclypeal area, mesothorax, and scutellum strongly polished; mandibles reddened in middle; antennæ red, short, but the scape long; front with a shining band leading to each lateral ocellus; tubercles appearing pallescent, with dense hair; tegulæ pale testaceous; wings hyaline, with large dusky reddish stigma; basal nervure not nearly reaching nervulus; second cubital cell large, receiving recurrent nervures some distance from base and apex; marginal cell long, narrowed at end; legs clear ferruginous, the hind tibiæ with abundant dull white hair; abdomen shining, light ferruginous, with thin bands of pale hair, and pale hair at apex. The tongue has the lobes very short and obtuse, with a shallow sinus between (in *S. semirufa* Ckll. the lobes are pointed and produced, with a deep sinus). The mesothorax and scutellum are very sparsely punctured on disc, but posteriorly the

mesothorax has a fine dense sculpture, with a lineolate effect as seen under the microscope. There are long, deep, linear facial foveæ close to the anterior orbits.

S.W. Africa : Seeheim, Feb. 18, 1934 (*J. Ogilvie*).

A very neat little species, running in Friese's table next to the much larger *S. flavipes* (Friese), from Zululand.

Morgania (Omachthes) indecisa, sp. n.

♀.—Length about 5 mm., anterior wing 4.

Robust, with broad face; head and thorax black, with scanty white hair, but a conspicuous spot at each side of postscutellum, and a patch at each side of metathorax, eyes black; mandibles and labrum (but not margin of clypeus) dark reddish; clypeus glistening but not polished, almost without sculpture, though the sides of face are well punctured; antennæ black, very obscurely reddish beneath; scutellum shining, bigibbous; mesothorax shining but well punctured, with a strong median groove; tegulæ red; wings greyish, a little darker apically; marginal cell broadly, obliquely truncate; second cubital cell receiving first recurrent nervure some distance from base, the second recurrent meeting outer intercubitus (on one side, owing to a fold, the second recurrent seems to join second cubital cell before the end, but this is illusory); legs very robust, bright red; abdomen short and broad, clear red, without hair-spots, and not appreciably blackened at end; apical truncation very distinct.

Cape Province : Nels Poort, Dec. 5, 1933 (*J. Ogilvie*).

In Bischoff's table it runs nearest to *M. apicalis* Bisch., from Willowmore, but it lacks the black marks on abdomen. It is more or less intermediate between *M. turneri* Ckll. and *M. minutissima* Ckll., but is distinct from both.

III.—*New and little-known African Bees of the Subfamily Anthidiinæ (Apoidea).*—Part I. By G. A. MAVRO-MOUSTAKIS, Limassol, Cyprus.

THIS interesting collection of Anthidiine bees was received from the British Museum through the kindness of Mr. Robert B. Benson. To Mr. Robert B. Benson and to Herr Professor H. Bischoff I am greatly indebted

for their kind aid in interpreting for me certain types of Smith, Strand, and Friese in the British Museum and the Berlin Zoological Museum. To Professor T. D. A. Cockerell my thanks are due for the interpretation of some of his types of African Anthidiinae. The types of the new species and the new varieties are placed in the British Museum.

Anthidium concolor Friese, female, nov.

Anthidium concolor Friese, ♂, in Zool. Jahrb. xxxv. Abt. f. Syst. p. 596.

Female.—Length 7 mm.

Entirely black; clypeus punctured, lower margin with seven small rounded tubercles; mandibles black-brown with six rounded reddish-brown teeth; occiput and vertex shining, finely and somewhat densely punctured; scape black; flagellum black-brown; front, sides of face with some sparse white hairs; vertex, occiput with dull yellowish-white hairs, outer side of cheeks with shining white hairs above, and white hairs at sides; wings nearly clear, upper half of marginal cell slightly clouded; second recurrent nervure interstitial with second transverse cubital nervure; tegulae black-brown with subhyaline margin in front; femora black, anterior and middle ones with an apical deep yellow mark beneath; anterior tarsi reddish brown; middle and hind tarsi black, but the small joints 2 to 5 reddish brown; hind basitarsi covered with yellowish-brown hairs on inner side, and with an apical short spine; pulvilli absent. Abdomen black, shining, sparsely and very finely punctured; apical margins of tergites 1 to 5 very narrow and brown; abdomen with some white hairs above, especially in front and at sides; ventral scopa yellowish brown.

SOUTH AFRICA, Cape Province, Matjesfontein, 1♀, 16–21. x. 1928 (*R. E. Turner*).

Anthidium sjöstedti Friese
var. *rhodesianum*, nov. (Fig. 1.)

Anthidium sjöstedti Friese, ♂, in Sjöstedt, Kilimandjaro-Meru Exp. viii. 5, 1909, p. 158.

Male.—Length 7 mm., fore wing 5.5 mm.

Black; clypeus, lateral face-marks (filling space between clypeus and eyes) reaching level of top of clypeus, yellow;

mandibles tridentate, teeth black-brown; antennæ black, third joint shorter than fourth, but fourth and fifth equally long; vertex dullish, densely punctured; occiput normal; face below antennæ covered with long and dull yellowish-white hairs; cheeks with some shining white hairs. Thorax entirely black; mesonotum dullish, densely punctured; scutellum rounded at sides, between axillæ and scutellum an incision; tegulæ black-brown with hyaline margin in front; thorax with long, dull yellowish-white hairs above and dense shining white hairs at sides; wings nearly clear, upper half of marginal cell and apical margin clouded; nervures yellowish brown; second recurrent nervure nearly interstitial with second transverse cubital nervure; femora black; tibiæ orange-yellow above; anterior and middle tibiæ at base beneath and hind ones beneath, black-brown; tarsi yellow, small joints 2 to 5 of anterior and middle tarsi and 3 to 5 of hind ones, yellowish brown; basitarsi short, shorter than tibiæ and covered with dense and short yellowish-brown hairs; legs with somewhat long white hairs; spurs pale yellow; no pulvilli. Abdomen black and shining; apical margin of first and second tergites narrow, impunctate and shining, those of tergites 3 to 5 narrow, impunctate and subhyaline, except the sides; first tergite somewhat densely punctured; second and third tergites with basal half sparsely punctured and rest finely and somewhat densely punctured; first and second tergites with large lateral yellow stripe; third tergite with a transverse yellow stripe, broadly interrupted in middle and attenuated within; fourth and fifth tergites mostly yellow, except a transverse narrow black stripe above apical margins; sixth and seventh tergites yellow; sixth tergite rounded laterally; seventh tergite rounded laterally, apical margin bilobed (the apex of lobes rounded) and between the lobes an incision; seventh tergite with median longitudinal carina protruding slightly in the incision (fig. 1); abdomen with some yellowish-white hairs above and somewhat dense yellowish hairs at sides.

SOUTHERN RHODESIA, Mashonaland, Salisbury, 1♂ (type), Jan. 1900 (*G. A. K. Marshall*).

The new variety possesses the scutellum black, the third tergite with broadly interrupted yellow stripe,
Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 3

the nervures yellowish brown, and apical margins of tergites 3 to 5 narrow, impunctate, and subhyaline.

Anthidium lanitarse Friese var. *lloydi*, nov.

Female.—Length 9 mm., breadth of abdomen 4 mm.

Head reddish brown; all face below antennæ, entire and broad occipital stripe a little descending on cheeks pale yellow; mandibles yellow with black-brown teeth (the apical longer); antennæ reddish brown; thorax reddish brown; scutellum rounded at sides and subemarginate in middle; axillæ and apical margin of scutellum broadly pale yellow; a broad L-shaped pale yellow stripe at sides of mesonotum; on each side of middle of mesonotum a longitudinal pale yellow stripe nearly reaching axillæ; wings nearly clear, upper half of marginal cell clouded; nervures of basal half of wings yellowish brown, rest of nervures brown; first and second recurrent nervures interstitial with first and second transverse cubital nervures; anterior femora reddish brown with a narrow yellow stripe beneath; middle femora yellow and nearly reddish brown beneath; hind femora nearly reddish brown with yellow apex above; tibiæ yellow above and reddish brown beneath; hind basitarsi shorter than the long hind tibiæ and densely covered with dense reddish-brown hairs on inner side; basitarsi very densely covered with whitish hairs on outer side; small tarsal joints 2 to 5 reddish brown. Abdomen reddish brown; tergites 1 to 5 with a basal and very broad, transverse, pale yellow stripe, medianly notched above on tergites 1 to 4; sixth tergite pale yellow and nearly covered with short whitish hairs.

NIGERIA, Azare, type ♀, 1924 (*Ll. Lloyd*).

The new variety agrees structurally with the typical form from S.E. Algeria, and differs by the mostly reddish-brown head and thorax.

Anthidium severini Vachal.

Anthidium severini Vachal, ♂, in Ann. Soc. Ent. Franco, vol. lxxii, p. 374.

Male.—Length 13.5 mm.

First and second tergites black with broad yellow lateral mark; mesonotum strongly punctured, the punctures shining; tegulæ finely punctured; antennæ black; third joint somewhat longer than second or fourth;

sixth tergite with lateral tooth, but between teeth and apical margin without incision; seventh tergite with two broad rounded lobes and between the lobes an incision.

NORTH RHODESIA, Upper Luangua River, 1 ♂, 27. vii.-13. viii. 1910 (*S. A. Neave*).

Anthidium severini Vach. var. *maximum* (Fries).

Anthidium maximum Fries, ♂, in Zool. Jahrb. xlv. Abt. f. Syst. pp. 32-33.

Male.—Length 13.5 mm.

Thorax black; first and second abdominal tergites black with broad yellow lateral mark; third tergite black with a long lateral yellow stripe not reaching middle, apical margin reddish brown; the form of sixth and seventh tergites, as well as the sculpture of mesonotum and abdomen, as *Anthidium severini* Vach.

NYASALAND, Lingadji, nr. Domira Bay, 1700 ft., 2 ♂♂, 4. vii. 1915 (*W. A. Lamborn*).

Anthidium maximum has been described by Fries as a distinct species, but this is only a variety of *Anthidium severini* Vachal. Professor Bischoff has kindly compared for me one of the above specimens from Nyasaland with the typical specimen of *Anthidium maximum* Fries from Zululand (Berlin Zoological Museum), and informed me that both specimens belong to the same species. Besides this Herr Bischoff has informed me that in the typical specimen of *Anthidium maximum* Fries the fifth and sixth ventral segments are "mitten ausgerandet" and "gekielt und jederseits am Rande gehöckert" instead of the fourth and fifth ventral segments as mentioned in the description of Fries.

Anthidium severini Vachal
var. *daressalamicum* Strand.

Anthidium severini Vachal var. *daressalamicum* Strand, ♂, in Ent. Rundschau, xxviii. 1911, p. 122.

Scutellum with a narrow apical yellow stripe medianly interrupted and axillæ with yellow spot; mesonotum with an L-shaped yellow stripe at sides reaching axillæ; the tegumentary colour of abdomen is the same as in *Anthidium severini maximum* (Fr.).

NORTHERN RHODESIA: 70 miles W. of Kariba Gorge, 1 ♂, 21. vi. 10 (*Silverlock*); Upper Luangua R., 2 ♂♂, 27. vii. to 13. viii. 1910 (*S. A. Neave*). One of the males

from Upper Luangua R. differs from *Anthidium severini daressalamicum* Strand by the third tergite being reddish brown with long lateral yellow stripe.

Anthidium braunsi Friese. (Fig. 2.)

SOUTH AFRICA, Cape Province: Willowmore, 2 ♀♀, 20. xi. 1909, 2 ♂♂, 1. xii. 1902, and 1 ♂ (cotype), xii. 1907 (collected and determined by H. Brauns); Mossel Bay, 1 ♂, xii. 1921; Aliwal North, 1 ♀, xii. 1922; Somerset East, 5 ♂♂, 3 ♀♀, 1-9. xii. 1930; Montagu, 1 ♂, 2 ♀♀, 1-21. x. 1921; Orange Free State, Harrismith, 5 ♀♀, ii. 1927 (*R. E. Turner*).

Sixth abdominal tergite rounded laterally; seventh tergite with two broad rounded lobes and between the lobes a deep (fig. 2) or a slight incision; base of femora black, rest reddish brown (hind femora with apex reddish brown) or femora black with apex broadly reddish brown

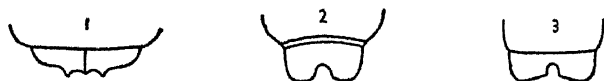


Fig. 1.—Sixth and seventh abdominal tergites of *Anthidium sjöstedti* var. *rhodesianum*, nov., ♂.

Fig. 2.—Sixth and seventh abdominal tergites of *Anthidium braunsi* Friese, ♂.

Fig. 3.—Sixth and seventh abdominal tergites of *Anthidium braunsicum*, sp. n., ♂.

Anthidium braunsicum, sp. n. (Fig. 3.)

Female.—Length 6.5 mm.

Head black; clypeus black, lower margin broadly reddish brown; clypeus shining somewhat strongly punctured, but toward the lower margin finely and densely punctured; mandibles yellow, apex reddish brown and with five black-brown teeth; scape black, except the yellowish-brown base and apex; first joint of flagellum black, apex yellowish brown; otherwise flagellum yellowish brown; second joint shorter than 3+4; vertex and occiput shining, somewhat strongly punctured; a broad and deep yellow occipital stripe nearly reaching middle of cheeks; no conspicuous hairs on head, except some short and very sparse yellowish-white hairs on vertex and occiput. Thorax black and

shining; mesonotum very strongly and somewhat sparsely punctured; scutellum very strongly and sparsely punctured, slightly projected, rounded at sides and with a median slight incision; axillæ and apical margin of scutellum broadly ochreous (the ochreous on scutellum medianly interrupted by reddish brown); a short ochreous stripe on each side of mesonotum above; tubercles pale yellow; tegulæ yellowish brown with yellowish-white mark and hyaline margin in front; area of meta-thorax shining, punctured above and impunctate below; wings nearly clear; second recurrent nervure out of second transverse cubital nervure; femora light reddish brown; anterior and middle femora with narrow pale yellow stripe beneath; middle and hind femora very narrowly black-brown at base beneath; tibiæ light reddish brown with a basal pale yellow mark above; anterior and middle tarsi light reddish brown; hind tarsi with basitarsi brown, apex of basitarsi and small joints 2 to 4 dark brown, last joint reddish brown; hind basitarsi covered with short golden hairs on inner side; spurs pale yellow; no pulvilli. Abdomen shining; apical margins of tergites 1 to 4 narrow, impunctate, and shining, ochreous with light reddish-brown suffusion; tergites somewhat strongly punctured; basal margin of first and second tergites black (basal margin of second laterally reddish brown), rest ochreous with narrow reddish-brown stripe above apical margin; the ochreous on first and second tergites nearly interrupted on each side of middle by reddish brown; third and fourth tergites with basal margin very narrowly reddish brown, rest ochreous with a very narrow reddish-brown stripe above apical margin; the ochreous on third tergite notched on each side of middle above by reddish brown; fifth tergite ochreous with apical margin and linear stripe above, reddish brown; sides of fifth tergite above reddish brown; sixth tergite black-brown with dark reddish-brown marks; ventral scopa white; no hair on thorax above, but sides with some white hairs.

Male.—Length 7 mm.

Head black; all face below antennæ ochreous; mandibles ochreous, teeth black-brown; scape pale yellow beneath; second joint black, except apex; rest of flagellum light reddish brown; fourth and fifth antennal

joints broader than third; a broad and deep yellow occipital stripe covering cheeks and reaching middle (inner side of the stripe on cheeks pale yellow); front, sides of face, clypeus with dense shining white hairs; vertex with some very short yellowish-white hairs. Mesonotum without hairs, except some very short and sparse whitish hairs in front; sides of thorax with dense shining white hairs; second recurrent nervure out of second transverse cubital nervure; femora nearly pale yellow beneath; tibiae pale yellow, light reddish brown beneath; tarsi pale yellow; hind tarsi with apex of basitarsi, fourth and fifth joints yellowish brown. Abdomen similar to the female; base of first and second tergites black in middle and narrowly light reddish brown at sides; third tergite with basal margin light reddish brown; fourth and fifth tergites mostly ochreous with light reddish-brown base laterally and a linear light reddish-brown stripe above apical margins; sixth and seventh tergites ochreous; sixth tergite with parallel sides, without lateral teeth and with straight apical margin; seventh tergite with two broad lobes and deeply incised as *Anthidium braunsi* Friese, but the apical margin straight toward the apex of the incision (fig. 3); ventral segments light reddish brown; sixth ventral segment with two broad lobes and between the lobes an incision.

S.W. AFRICA, Aus: 1 ♀ (type), 1 ♂ (allotype), and 1 ♀ (paratype), xii. 1929 (*R. E. Turner*). SOUTH AFRICA, Cape Province: Willowmore, 1 ♂ (paratype), 10. xii. 1902, and 1 ♂ (paratype), 20. xii. 1902 (*H. Brauns*).

Differs from the type as follows:—Lower half of clypeus reddish brown; femora light reddish brown, anterior and middle ones with short pale yellow stripe beneath; hind tarsi yellowish brown, except the brown small joints 2 to 4; first and second tergites reddish brown with a transverse and broad median ochreous stripe, interrupted on each side of middle by reddish brown; third tergite coloured as the preceding, but the ochreous stripe notched on each side of middle above by reddish brown and between ochreous stripe and apical margin reddish brown at sides and black-brown in middle; fourth tergite ochreous, basal margin narrowly reddish brown at sides and black-brown in middle, and between ochreous and apical margin a narrow reddish-brown stripe;

fifth tergite ochreous, but broadly the apical margin reddish brown; sixth tergite reddish brown; ♂, Aus. Dec. 1929 (*R. E. Turner*), with basal margin of first and second tergites light reddish brown. The paratypes from Willowmore are placed in Transvaal Museum.

This interesting species differs from *Anthidium rebellulum* Ckll. by the form of scutellum, which, as Mr. Professor Cockerell has kindly informed me, is rounded, and by many colour and structural details. It differs from *Anthidium braunsi* by the form of the last abdominal tergites of the male. *Anthidium minutulum* Brauns is smaller with rufous clypeus, scopa and legs, and the area of the metathorax dull. *Anthidium braunsi-cum*, sp. n., is a member of a group related to the South American *Hypanthidium*.

Anthidium immaculatum Smith.

Mr. Robert B. Benson has kindly examined the type of *Anthidium immaculatum* Smith in the Hope Department, Oxford, and informed me the following:—Pulvilli absent; second recurrent nervure interstitial with second transverse cubital nervure; scutellum normal; abdominal tergites dark with slightly paler membranous apical margins; on fourth tergite the apical margin is creamy white and opaque; pubescence white on femora and tibiæ as well as on the outer side of basitarsi; fulvous on the inner side of basitarsi and on the rest of the tarsi; head dark; pubescence on face and behind the eyes at sides white.

Anthidium quadridens Brauns.

Anthidium quadridens Brauns, ♂, in *Z. Insbiol.* vol. xxiv. 1929, p. 137.

Anthidium quadridens was described by Brauns from the male and is closely related to *Anthidium immaculatum* Smith, of which it seems to be the unknown male. Mr. G. van Son has kindly examined the type of *Anthidium quadridens* Brauns in Transvaal Museum and informed me the following:—Abdomen above sparsely clothed with fulvous hairs, underside of abdomen clothed with white hairs; scutellum rounded behind; pulvilli absent; second recurrent nervure interstitial; clypeus light yellow, slightly emarginate below. As regards that species Herr Professor Bischoff wrote to me the following:—Of *Anthidium quadridens* Brauns the collection of

Friese (Berlin Zoological Museum) contains a ♂ and a ♀ from Aliwal North which very likely originate from the typical series of Brauns. The pubescence is not quite so dense as mentioned in the description, because one can see the ground-sculpture everywhere. The pale stripes of abdominal tergites are confined to the translucent hind margins. The sculpture on head and thorax is very fine and dense and without lustre. The abdomen is punctured considerably more sparse and coarse than thorax and possesses contrary to the description by all means a distinct lustre. The seventh tergite with the anterior teeth somewhat more hook-like bent, and with the inner ones parallel-sided and with blunt tip.

Anthidium mlanjense, sp. n. (Fig. 4.)

Female.—Length 8.5 mm., breadth of abdomen nearly 4 mm.

Entirely black and hairy, superficially like an *Osmia* of the group of *Osmia rufa* L. Mandibles black with five reddish-brown teeth; in one of the mandibles the interval between basal and second tooth with three small denticles, and that between second and third with three similar denticles; in the other one the interval between basal and second tooth with a small denticle, and that between second and third with two similar denticles; clypeus punctured and shining, lower margin with six small denticles; antennæ black; all face below insertion of antennæ with very dense and long yellowish-white hairs; otherwise head densely covered with long fulvous hairs. Thorax densely covered with fulvous hairs above and with similar yellowish-white hairs at sides; mesonotum finely and densely punctured and dull; tegulae black with pale yellowish-brown margin; wings subclouded, upper half of marginal cell clouded; second recurrent nervure interstitial with second transverse cubital nervure; femora, tibiae black and covered with yellowish-white hairs; anterior and middle tarsi, except the light reddish-brown fourth and fifth small joints, black, and densely covered with fulvous hairs; hind tarsi black, except the light reddish-brown last small joint, and densely covered with fulvous hairs on inner side and with yellowish-white hairs on outer side; no pulvilli; spurs yellow. Abdomen shining; basal margin of first

tergite punctured, rest finely punctured; basal half of second and following tergites finely punctured, but rest finely and densely punctured; apical margins of tergites 1 to 5 narrow, impunctate, and pale yellowish brown; sixth tergite bluntly pointed; abdomen above and at sides with dense and long fulvous hairs; ventral scopa long and dense, entirely bright fulvous.

Male.—Length 8.5 mm.

Mandibles, except the reddish-brown teeth, black; clypeus yellow, long and rounded above (lower margin which is visible in the paratype with six small denticles); lateral face-marks reaching level of top of clypeus (filling space between clypeus and eyes), yellow; antennæ black and long; second antennal joint smaller than third; third joint somewhat longer than fourth; apical margins of tergites 1 to 5 broadly pale yellowish brown; sixth tergite rounded at sides and with very narrow pale

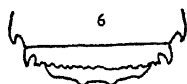
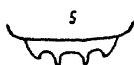
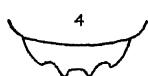


Fig. 4.—Sixth and seventh abdominal tergites of *Anthidium mlanjense*, sp. n., ♂.

Fig. 5.—Sixth and seventh abdominal tergites of *Anthidium capense*, Cam., ♂.

Fig. 6.—Fifth to seventh abdominal tergites of *Anthidium capicola* Brauns, ♂.

yellowish-brown apical margin; seventh tergite reddish brown with four broad lobes, the lateral lobes very short and the middle ones somewhat longer (fig. 4); ventral segments black, apical margins pale yellowish brown; sixth ventral segment flat with apical half yellowish brown, apical margin truncate with slight excavation in middle; abdomen above and at sides with somewhat dense and long fulvous hairs; apical margins of segments covered with long fulvous hairs; anterior tibiæ with yellowish-brown stripe beneath; tarsi, except the last reddish-brown small joint, suffused with brown (in the paratype tarsi nearly reddish brown).

NYASALAND, Mlanje Plateau, 6500 ft., 1 ♀ (type), 1 ♂ (allotype), 1 ♀ and 2 ♂♂ (paratypes), 18. xii. 13 (S. A. Neave).

This species possesses a different pilosity and structure from *Anthidium quadridens* Brauns. *Anthidium capense* Cam., with the lobes of seventh tergite slender (fig. 5) and with the narrow apical margins of tergites 1 to 5 whitish and opaque, is different from *Anthidium mlanjense*, sp. n.

Anthidium capicola Brauns. (Fig. 6.)

SOUTH AFRICA, Cape Province: Matjesfontein, 2 ♀♀, 2 ♂♂, 1-18. xii. 1928, and 2 ♂♂, 14-27. xi. 1928; Ceres, 1500 ft., 4 ♀♀, xii. 1920, 1 ♂, xi. 1930, and 1 ♀, 1921; Little Karroo, 38 miles E. of Ceres, 1 ♀, 17-25. xi. 1921 (*R. E. Turner*).

Anthidium hypocapicola, sp. n. (Fig. 7.)

Male.—Length 6 mm.

Superficially like *Anthidium capicola* Brauns. Head black and shining, finely punctured; front, sides of face, clypeus with shining white hairs; vertex and occiput with somewhat long and dense yellowish-white hairs; cheeks with short and sparse white hairs; a yellow mark above top of eyes; a linear yellow stripe along inner orbits to the top; mandibles, except the apex, yellow; scape, second antennal joint black, but the apex yellowish brown; base of third joint suffused with brown, rest yellowish brown; otherwise flagellum yellowish brown beneath and brown above. Thorax black, shining, and punctured; scutellum rounded, apical margin yellow; tubercles black, apex yellowish; tegulae black-brown with pale yellow mark in front; wings clear, second recurrent nervure very slightly out of second transverse cubital nervure; area of metathorax shining, punctured above; pilosity on thorax white, scanty above and dense at sides; anterior femora mostly light yellowish orange, but base to middle black-brown beneath; middle and hind femora, except the black-brown base, light yellowish orange; tibiae light yellowish orange, hind ones with a black-brown mark apically on inner side; anterior and middle tarsi light yellowish orange; hind tarsi yellowish orange, except the brown apex of basitarsi, and second and third small joints; spurs yellow; no pulvilli; legs with some white hairs; inner side of hind basitarsi covered with dense and short fulvous hairs. Abdomen black and shining; tergites 1 to 5 with a median transverse and

narrow yellow stripe (the stripe on fourth and fifth broad); sixth tergite with a broad yellow stripe not reaching sides; seventh tergite yellow at sides, rest black-brown; between the yellow stripe and the narrow apical margins a brown suffusion; first tergite finely punctured; second and following tergites with basal half finely punctured and apical half (except the impunctate apical margin) finely and densely punctured; sides of tergites unarmed and rounded; sixth tergite with apical margin subcrenulate, slightly incised in middle and resulting to a lateral tooth; seventh tergite briefly bilobed and between the lobes a slight incision possessing medianly a slight projection (fig. 7); abdominal tergites with some white hairs; ventral segments mostly yellowish orange; sixth ventral segment flat with rounded apical margin.

Female.—Length 6 mm.

Aspect of the male; clypeus punctured and shining, but longitudinally and broadly with median area polished.

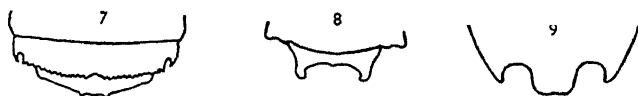


Fig. 7.—Fifth to seventh abdominal tergites of *Anthidium hypocapicola*, sp. n., ♂.

Fig. 8.—Sixth and seventh abdominal tergites of *Plesianthidium carini-ventre* (Friese), ♂.

Fig. 9.—Seventh abdominal tergite of *Plesianthidium fulvopilosum* Cameron, ♂.

except the punctured lower margin; femora black, apex light yellowish orange; tibiae light yellowish orange, hind tibiae apically with a broad black-brown mark; anterior and middle tarsi light yellowish orange; hind tarsi black-brown, last small joints brown; thorax above with some sparse yellowish-white hairs; tergites 1 to 5 with a median transverse and narrow pale yellow stripe, that on fifth not reaching sides; sixth tergite black with subcrenulate and rounded apical margin; sides of abdomen unarmed; abdomen above with some sparse and very short white hairs; sixth tergite with somewhat dense white hairs; ventral scopa white, except the yellowish-white base.

SOUTH AFRICA, Cape Province: Matjesfontein, 1 ♂ (type) and 1 ♂ (paratype), 14–27. xi. 1928, 1 ♀ (allotype), 7–13. xi. 1928 (*R. E. Turner*). In the paratype the clypeus has a reversed yellow T, and fifth tergite slightly angulate at sides.

Related to *Anthidium capicola* Brauns, but the female of *A. capicola* has a narrow longitudinal median smooth line on clypeus, the sides of tergites 3 to 5 angulate, the legs mostly black, the structure and colour different, and the male has the fifth and sixth tergites toothed laterally, the apical margin of seventh tergite briefly bilobed and incised and between the lobes without median projection (fig. 6).

Plesianthidium cariniventre (Frieze). (Fig. 8.)

Megachile cariniventre Frieze, ♂, in *Zschr. Hymenopt.* vol. iv. p. 334.

Anthidium cariniventre Frieze, ♂, in *Bienen Afrikas*, p. 354.

Anthidium cariniventre Frieze, ♀, in *Zool. Jahrb. xxxv. Abt. f. Syst.* pp. 594–595.

SOUTH AFRICA, Cape Province: Willowmore, 1 ♂, 10. x. 1919, collected and determined by H. Brauns.

Pulvilli present, second recurrent nervure slightly out of second transverse cubital nervure; scutellum normal; maxillary palpi 3-jointed, first and third joints very short.

Plesianthidium fulvopilosum Cameron. (Fig. 9.)

A male from Ookiep in Transvaal Museum.

Anthidiellum orichalciscopatum (Strand).

Anthidium orichalciscopatum Strand, ♀, in *Mitt. Mus. Berlin*, vi. 1912, p. 307.

Anthidiellum auriscopatum (Strand).

Anthidium auriscopatum Strand, ♀, in *Mitt. Mus. Berlin*, vi. 1912, p. 308.

Anthidiellum eritrum (Frieze).

Anthidium eritrum Frieze, ♀, in *Deutsch. Ent. Zeitsch.* 1915, Heft iii. pp. 295–96.

Anthidiellum kimberleyana (Frieze).

Anthidium kimberleyana Frieze, ♀, in *Zool. Jahrb. xlv. Abt. f. Syst.* pp. 30–31.

Herr Professor Bischoff has kindly examined for me the types of the above four species of *Anthidiellum* (Berlin Zoological Museum), and informed me the following:—*A. orichalciscopatum* with the lower margin of clypeus

possessing four very small tubercles, scutellum projected, second recurrent nervure out of second transverse cubital nervure, pulvilli present. *A. auriscopatum*, *A. eritrinum*, and *A. kimberleyana* with the scutellum, venation, pulvilli as the preceding, but *A. auriscopatum* with the lower margin of clypeus possessing six very small tubercles.

Anthidiellum aspidopodum, sp. n.

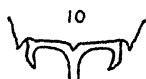
Female.—Length about 7 mm.

Black with yellow markings; head black; clypeus pale yellow, shining, well punctured, broader than long, lower margin black with three rounded tubercles; mandibles black with two apical stout teeth and a basal one divided in two small denticles; lateral face-marks (filling space between clypeus and supraclypeal area and eyes) truncate above and nearly reaching level insertion of antennæ, lemon-yellow; supraclypeal area, except the black middle of upper part, lemon-yellow; scape black, flagellum black-brown beneath and black above; vertex, occiput strongly punctured and shining; front, sides of face, clypeus with some short and sparse shining white hairs; vertex and occiput with some very sparse and short whitish hairs. Thorax black; mesonotum strongly and densely punctured, shining; scutellum projected, rounded at sides and incised in middle; tubercles angular, slightly erected, black and narrowly yellowish in front; tegulæ finely punctured, black-brown, outer margin and median mark brown and subhyaline in front; wings clear, apical margin slightly clouded; second recurrent nervure out of second transverse cubital nervure; femora dark brown; anterior and middle tibiæ dark brown above and brown beneath; a small basal pale yellow mark on anterior and middle tibiæ above; hind tibiæ lemon-yellow with a broad median black-brown mark above; inner side of hind tibiæ brown; anterior and middle tarsi brown, apical joints yellowish brown; hind tarsi with basitarsi yellow, second and third small joints brown, fourth and fifth yellowish brown; hind basitarsi flat and very broad (base as broad as apex) and densely covered with short and dense yellowish-brown hairs on inner side; legs with some short white hairs; spurs pale yellow; pulvilli developed. Abdomen black and shining; first tergite sparsely punctured, apical margin

finely and somewhat sparsely punctured; second tergite well punctured; third and fourth tergites well punctured, the punctures shallow and somewhat sparser than that of the preceding; apical margins of tergites 2 to 5 narrow, impunctate and shining; first and second tergites with a broad lateral yellow mark and below the yellow light reddish brown; third tergite with a longer lateral yellow mark; fourth tergite with a deep yellow lateral mark longer than that on third, but not reaching middle; apical margin of fourth tergite nearly deep yellow; fifth and sixth tergites deep yellow; a black basal spot on fifth tergite; ventral scopa shining, very light golden; some white hairs at sides on anterior tergites.

SOUTHERN RHODESIA: Lonely Mines, 1 ♀ (type), 1914 (*H. Swale*); Bulawayo, 1 ♀ (paratype), 19. xii. 1926, differs from the type in that the median basitarsi are yellowish above; the paratype is placed in the Rhodesian Museum.

This species is related to *Anthidiellum tegwaniense* Ckll., but Professor Cockerell wrote me concerning his *A. tegwaniense* as follows:—"Head and thorax above coarsely sculptured and dull, a little shining in region of ocelli, lower margin of clypeus black with six very small nodules." *Anthidiellum medionigrum* Ckll., from Natal, possesses dull mesonotum and black antennæ.



Sixth and seventh abdominal tergites of
Dianthidium neli (Brauns), ♂.

Dianthidium neli (Brauns). (Fig. 10.)

Anthidium neli Brauns, ♂♀, in Z. Insbiol. vol. xxiv. pp. 139-140.

SOUTH AFRICA: Cape Province, Ceres, 1 ♀, xi. 1920 (*R. E. Turner*); Matjesfontein, 1 ♂, 1 ♀, 6-15. x. 1928 (*R. E. Turner*); Stellenbosch, 1 ♀, 12. x. 1926, and 1 ♂, 20. ix. 1924, determined by Brauns.

Pulvilli present, second recurrent nervure out of second transverse cubital nervure, scutellum normal; seventh tergite with three projected teeth, the lateral teeth bent inside and apically pointed and the median tooth longer than the lateral ones (fig. 10); two other females from Matjesfontein, 22-23. x. 1928, and 16-21. xi. 28 (*R. E.*

Turner) differ somewhat from the topotypical specimens by the tarsi being entirely reddish brown and the apex of the tibiæ very broadly reddish brown.

Pachyanthidium lanificum (Smith)
var. *simpsoni*, nov.

A small yellow mark above top of eyes ; first abdominal tergite black with a very small yellow mark at sides ; second tergite black ; third and fourth tergites black with a small yellow mark on each side of middle not reaching sides ; fifth and sixth tergites entirely black.

SIERRA LEONE: Ka-Yima, 1 ♀ (type), 25. vi. 1921, 1 ♀ (paratype), 26. vi. 1912 (*Jas. J. Simpson*).

IV.—*New Species of Lasiocampidæ from
Neotropical Countries.* By W. SCHAUS.

Gloveria balloui, sp. n.

Male.—Body brownish olive with brighter brown hairs on thorax posteriorly and on basal half of abdomen from base. Fore wing brownish olive with light brownish-olive mottling on basal area ; a white point on discocellular followed by a broad light greyish-olive band somewhat hyaline, slightly broader towards costa, crossed by dark veins ; the terminal dark space wider at apex. Hind wing brownish olive with brighter hairs at base and along inner margin. Wings below dark brownish olive. Fore wing with a darker spot at end of cell, the transverse band slightly broader and continued on hind wing as a dull paler shade postmedially, not reaching inner margin.

Female.—Body light drab. Fore wing light greyish olive ; an irregular subbasal fine dark line ; a dark antemedial line outcurved at costa making the broad medial drab band broader at costa, this band outwardly edged by a nearly straight postmedial dark line, followed on costa by whitish grey at costa ; an irregular subterminal dark line outwardly edged by a fine dentate white line from costa to vein 6, preceded on costa by a drab shade. Hind wing light drab crossed by dark veins.

Expanse, male 46 mm., female 54 mm.

Habitat.—San Pedro de Montes de Oca, Costa Rica.

Type.—Cat. No. 34533, U.S. N. M.

Named after Mr. C. H. Ballou.

The species is allied to *G. olivacea* Hy. Edwards.

The wings are narrower, the fore wing with the apex more produced, the hind wing longer at anal angle, also different in colour. The larva feeds on pecan.

One male and three females in National Museum.

Tolype erisa, sp. n.

Male.—Head and collar hair-brown; thorax brownish drab; abdomen with alternate avellaneous and drab transverse lines, the anal hairs drab. Wings light drab, thinly scaled, the veins finely dark. Fore wing: the lines and faint submarginal spots whitish; antemedial line vertical to vein 2, below it curved to base of inner margin; postmedial line broader on costa, below vein 6 narrower, curved, and connected with antemedial line on vein 2, below vein 2 vertical. Hind wing: costal and outer margins suffused with whitish. Fore wing below without lines, the hind wing below paler with a medial line, expanding towards base below cell.

Expanse 37 mm.

Habitat.—Costa Rica?

Type.—Cat. No. 34543, U.S. N. M.

Two specimens from the Dognin Collection which had been received from Donckier as coming from Costa Rica.

Tolype quiescens, sp. n.

Male.—Head and collar in front drab, the latter posteriorly, also thorax and metathorax pale cinnamon-pink; abdomen with alternate pinkish-buff and drab transverse lines, the anal tufts drab-grey. Wings pale cinnamon-buff, the veins white, the lines pale ecru-drab. Fore wing: a light cinnamon-drab shade at base; a medial line on costa to a large round hair-brown spot at end of cell; a narrow postmedial line from costa inbent to end of cell and below it expanding to a double shade to inner margin; subterminal line broad, somewhat double, outcurved on costa, incurved at vein 5 and at tornus, cut by the veins, making the line somewhat macular. Hind wing with inner margin broadly light vinaceous-fawn to postmedial line, narrower below the

line to anal angle; faint traces of the postmedial and a subterminal line. Fore wing below light drab, becoming paler on inner margin and below vein 5; veins from cell white. Hind wing below as above.

Expanse 42 mm.

Habitat.—Rio de Janeiro.

Type.—Cat. No. 34551, U.S. N. M.

Collector, W. Schaus.

Tolype songoaria, sp. n.

Female.—Head and thorax benzo-brown. Abdomen dark cinnamon-drab. Wings drab. Fore wing: the lines white, rather narrow; antemedial line slightly outcurved to vein 1; a fuscous line on discocellular; postmedial line outbent from costa, incurved from vein 7 to vein 4, again outcurved and sinuously inbent to inner margin before tornus; a subterminal wavy line from apex to vein 2; cilia fuscous-brown. Hind wing: a fine dark line on discocellular; traces of a paler postmedial line; termen paler on interspaces. Wings below drab; postmedial line on fore wing faintly indicated, cut by the dark veins; the pale postmedial line on hind wing more distinct.

Expanse 50 mm.

Habitat.—Rio Songo, Bolivia.

Type.—Cat. No. 34549, U.S. N. M.

Tolype cydona, sp. n.

Male.—Body light drab; cinnamon-drab tufts laterally from metathorax. Fore wing somewhat hyaline, ecru-drab, the lines drab; base of costal edge cinnamon-drab; an outbent basal shade; antemedial line diffuse with distally drab streaks on interspaces; a small dark spot on discocellular; a postmedial drab shade from costa; subterminal line broad, outcurved on costa, incurved from vein 6 to vein 4, and again below vein 4 to tornus. Hind wing: costal margin to vein 4 ecru-drab; inner margin broadly light cinnamon-drab, the cilia finely dark cinnamon-drab. Wings below light cinnamon-drab; the costal margin broadly ecru-drab.

Expanse 42 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 34550, U.S. N. M.

Collected by Barnes and Schaus.

Tolyte melascens, sp. n.

Male.—Body black. Fore wing hair-brown, thinly scaled; a pale antemedial line preceded by a black spot in cell, and a larger spot on discocellular; a subterminal sinuous whitish line, and a finer marginal line from apex, macular from vein 6 to tornus. Hind wing hair-brown; below cell and along inner margin thickly scaled, chaetura drab; costal margin and termen to vein 2 like fore wing; an indistinct subterminal pale line. Wings below fuscous-grey, the outer pale lines faint.

Female.—Body dark hair-brown, the anal tufts black. Fore wing deep greyish olive; lines white, broad, the antemedial outcurved on costa, vertical, interrupted above inner margin, the subterminal line slightly sinuous, parallel with termen; a narrow duller line close to termen; veins finely black on terminal third; a black line on discocellular. Hind wing greyish olive; a pale postmedial shade. Wings below fuscous-grey, the lines slightly visible; no marginal line on fore wing.

Expanse, male 33 mm., female 52 mm.

Habitat.—Sta. Catharina, Brazil.

A bred pair collected by Fritz Hoffmann.

Tolyte damnata, sp. n.

Male.—Antenna cinnamon-buff. Body benzo-brown with vinaceous-buff mottling on metathorax and abdomen laterally. Fore wing ecru-drab, the veins finely dark; lines brownish drab; a fine subbasal line from subcostal, excurved with a short fuscous streak on it at antemedial line; antemedial line broad, outcurved on costa, then inbent to vein 1, followed in cell by a conspicuous black spot; postmedial line broad, straight, inbent from costa; a faint sinuous submarginal line, cut by veins; cilia dark cinnamon-drab. Hind wing somewhat darker, especially on inner margin; a faint darker outcurved postmedial line, the submarginal fine line more even. Fore wing below from base to postmedial line dark purple-drab; a pale streak in end of cell and a spot after the fuscous line on discocellular, the termen broadly suffused with ecru-drab. Hind wing below ecru-drab, the veins dark; a postmedial outcurved dark line, and a line on discocellular edging a small pale spot; cilia as above.

Expanse 45 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34546, U.S. N. M.

Tolyte frenata, sp. n.

Female.—Head and thorax brownish drab; abdomen drab. Fore wing ecru-drab; costal edge fuscous; veins on outer half drab, ending terminally at dark spots on cilia; base brownish drab with some small ecru-drab spots; antemedial line dentate on costal margin to the dark spot on discocellular, sharply incurved from end of cell; postmedial line drab, diffuse, parallel with termen; veins on outer half finely dark; inner margin suffused with cinnamon-drab. Hind wing ecru-drab, the veins darker; faint traces of the postmedial darker line; cilia brownish drab. Wings below ecru-drab, the veins dark; costal margin of fore wing broadly deep brownish drab, the costa of hind wing only narrowly so.

Expanse 53 mm.

Habitat.—Itatiaya Estado do Rio, Brazil.

Type.—Cat. No. 34548, U.S. N. M.

Received from J. F. Zikan.

Tolyte janeirensis, sp. n.

Male.—Head and front of collar hair-brown posteriorly, also thorax and base of abdomen dark drab; abdomen on terminal segments with transverse pale ecru-drab lines, and some pale yellowish laterally. Fore wing light drab, the lines whitish; antemedial line broad, vertical to vein 1, then inbent, finer, followed by a small dark line on discocellular; postmedial line broad on costa, incurved and narrower between veins 6 and 5, angled and slightly incurved to inner margin; the veins crossing this line white, but not reaching termen; termen whitish, proximally irregular. Hind wing ecru-drab with a faintly darker postmedial and subterminal line; cilia dark greyish brown. Wings below pale purple-drab with faint traces of lines, the postmedial on hind wing better defined.

Expanse 38 mm.

Habitat.—Virginia, Minas Geraes; also from Rio in Coll. Dognin.

Type.—Cat. No. 34547, U.S. N. M.

Tolyte marynita, sp. n.

Male.—Body light cinnamon-drab, darker shaded on head and collar; basal third of abdomen with dorsal russet-vinaceous tufts. Wings drab. Fore wing: a black point on discocellular; medial pale shades on interspaces; a postmedial pale narrow fascia very slightly curved; termen paler, becoming pale purplish vinaceous at tornus. Hind wing slightly paler on costa and termen. Fore wing below brownish drab, the inner margin and termen from vein 4 to tornus pale purplish vinaceous; traces of the postmedial pale shade from vein 5 to inner margin. Hind wing below: basal half, a broad postmedial and narrower terminal space pale brownish drab; a small dark spot on discocellular; terminal dark points on interspaces.

Expanse 40 mm.

Habitat.—Para, Brazil.

Type.—Cat. No. 34544, U.S. N. M.

Titya cain, sp. n.

Male.—Head and thorax pale vinaceous-fawn, the patagia with transverse drab-grey lines. Abdomen dark olive-buff with fine pale vinaceous-fawn transverse lines. Fore wing pale pinkish buff, crossed by numerous dark olive-buff lines; a basal line on costa; a round subbasal spot below cell; two antemedial and a medial line; a dark line on discocellular; three postmedial lines; a broader subterminal line, outcurved, indented at vein 5 and again at vein 3; the median and veins 2-6 with small fuscous points; a marginal line from costa to vein 5; terminal spots on interspaces. Hind wing vinaceous-buff, the costal margin and termen narrowly white. Wings below whitish suffused with light vinaceous-fawn, the lines on fore wing less prominent, the hind wing with a curved medial line.

Expanse 29 mm.

Habitat.—Itatiaya, Estado do Rio, 700 m.

Type.—Cat. No. 34581, U.S. N. M.

Received from J. F. Zikan.

Titya fraternans, sp. n.

Male.—Head and thorax light cinnamon-drab; abdomen light drab. Fore wing light drab with ochraceous-

salmon transverse lines; a basal and an antemedial line; a medial line and a small spot on costa above the fine dark discocellular line; two postmedial lines, incurved below vein 6 and 4; a subterminal line outbent on costa, incurved from vein 6 to end of vein 4, below it close to termen; cilia with white points at veins; the median and vens 2-6 finely black, forming points where cut by lines. Hind wing ecru-drab, whitish on costa. Wings below light drab with faint traces of paler lines which extend on to hind wing.

Expanse 31 mm.

Habitat.—Itatiaya, Estado do Rio, 700 m.

Type.—Cat. No. 34586, U.S. N. M.

Artace randa, sp. n.

Male.—Head and thorax white mottled with pale mouse-grey; collar in front dark drab. Abdomen dorsally on basal half greyish olive, terminal half with alternate greyish-olive and white bands. Fore wing pale mouse-grey, the veins broadly white; an antemedial black line across costa, and a broader medial line; the medial points incurved below cell; postmedial line of streaks outbent from costa, inset at vein 5 and inbent to inner margin; black points on discocellular; subterminal line outcurved from costa to vein 6 then punctiform, closely followed by the second line on interspaces which consists of larger spots; terminal fuscous spots on interspaces. Hind wing dull white; a postmedial macular line, deeply outcurved, expanding near anal angle; termen mouse-grey, becoming narrow from apex to vein 3. Fore wing below white, the costal margin suffused with greyish olive to near subterminal line, this latter fine, deeply outcurved from costa, punctiform and parallel with termen to inner margin. Hind wing below with the medial and terminal lines less pronounced.

Expanse 31 mm.

Habitat.—Alto da Serra, S. Paulo.

Type.—Cat. No. 34591, U.S. N. M.

Artace pelia, sp. n.

Male.—Palpi and face black; head and collar white, the collar with a few deep mouse-grey hairs; thorax completely covered by the broad white tegulæ. Abdomen

dorsally white, subdorsally hair-brown cut by segmental white lines, underneath white. Fore wing pallid mouse-grey the veins broadly white with black points; a sub-basal point on costa, and one on median at base of vein 2; an antemedial cross-line on costa and points on veins below it; small points at either end of discocellular; postmedial points on all the veins, those on veins 8 to 6 outcurved; subterminal series on veins, followed by a line of spots on interspaces; marginal short streaks on veins except vein 4; terminal black spots on interspaces. Hind wing pallid mouse-grey with the veins narrowly white; a faint subterminal greyish line expanding into a fuscous spot, below vein 2; small terminal black spots on interspaces. Fore wing below as above, but with only the subterminal spots on interspaces and the terminal spots; postmedial streaks on veins 6-10. Hind wing underneath as above.

Expanse 35 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34587 U.S. N. M.

Artace thelma, sp. n.

Male.—Very similar to *A. pelia* Schs., and differs in the following respects. Basal half of abdomen whitish with transverse mouse-grey bands, and dorsal short black tufts, the terminal half white. The fore wing has the subterminal series of black points on veins more prominent, the second line on interspaces only present between veins 6 and 9. The hind wing is without the dark spot at anal angle. Fore wing below without lines and the only points terminal and very small; costa from beyond base, expanding above end of cell to near termen dark greyish olive. Hind wing below as above.

Expanse 34 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34588, U.S. N. M.

Artace etta, sp. n.

Male.—This species is closely allied to the two previous species. Abdomen as in *A. thelma* Schs., but only the anal hairs are white. Fore wing: the points on veins extremely small; the second subterminal line distinct, as in *A. pelia*. Hind wing above and below similar to

A. thelma. Fore wing below with the subterminal spots on interspaces, but no points otherwise except on termen, the costa from middle to near termen dark greyish olive.

Expanse 29 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34589, U.S. N. M.

Artace melanda sp. n.

Male.—This species differs in having the abdomen above black, the anal hairs white, the fore wing as in *A. etta* Schs., the hind wing with a curved fuscous line at anal angle, but no terminal points. Fore wing below with the dark suffusions on costa as in *A. thelma* Schs. Hind wing below with anal mark very faint.

Expanse 32 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34590, U.S. N. M.

Artace athoria, sp. n.

Male.—Head, collar, and thorax white, the head and collar in front mottled with black hairs, the thorax with transverse dark mouse-grey bands. Abdomen dorsally deep mouse-grey with transverse white lines from base to beyond middle, the last two segments light mouse-grey with broader white bands, underneath white. Fore wing pallid mouse-grey somewhat hyaline except on costal edge, inner margin, and base, which are white; a subbasal outcurved black line on costa; antemedial line double on costal margin, closely followed by medial line, evanescent in cell, below cell sinuous, the medial line forming on inner margin a semioval spot, open on inner margin, curved on vein 2; all the veins with black points or streaks; the three series of postmedial streaks connected by faint ecru-drab lines, the last line followed by a series of subterminal spots on interspaces, those between veins 6 and 9 deep mouse-grey, below vein 6 fainter and lunular; terminal black spots or lines on interspaces. Hind wing semihyaline, pallid mouse-grey, the inner margin broadly white, also the veins and termen narrowly, a small dark spot at anal angle; traces of a dark terminal line on interspaces. Fore wing below pallid mouse-grey with fuscous lines on costal edge with buffy-olive suffusions from beyond base, expanding

beyond cell to the subterminal dark spots, not extending below vein 5; the terminal spots or lines as above. Hind wing below as above, the costal margin broadly white; no spot at anal angle.

Expanse 31 mm.

Habitat.—Sta. Catharina.

Type.—Cat. No. 34594, U.S. N. M.

Artace schreiteria, sp. n.

Male.—Palpi crimson; head pallid mouse-grey; collar and tegulæ cinnamon tipped with pallid mouse-grey; thorax black; abdomen dorsally purplish grey, laterally paler, underneath pinkish buff. Fore wing pale mouse-grey; costa finely dark reddish; veins partly cinnamon-buff, interrupted by fuscous points or streaks, the antemedial forming an outcurved line, the postmedial inbent to middle of inner margin; subterminal streaks on veins, parallel to termen; terminal thick black line on interspaces; cilia tipped with white; a fuscous mark at base below cell. Hind wing drab-white; the veins finely deep olive-buff, and a similar terminal line; some purplish-grey scaling at tornus. Fore wing below dark smoky drab with the markings fainter.

Expanse 29 mm.

Habitat.—Tucuman, Argentina.

Type.—Cat. No. 34592, U.S. N. M.

Euglyphis tapajosa, sp. n.

Female.—Head, collar laterally, and patagia mouse-grey mottled with darker hairs; collar medially and thorax fuscous; metathorax and abdomen with large tufts of bistre hair, the tufts on abdomen becoming snuff-brown terminally, the abdomen laterally brownish drab. Fore wing at base and above vein 4 to costa pale ochraceous drab irrorated with light drab; a medial thick fuscous sinuous and inbent line to inner margin antemedially followed in cell by a quadrate patch ending at a thick line on discocellular; a postmedial thick fuscous line well outbent from costa, rounded and sinuously inbent to vein 4, closely followed by a narrow much fainter parallel line; the medial space beyond antemedial line dull drab with a fuscous line along inner margin; the space between veins 3 and 4 deep greyish brown to subterminal line, extending below veins 4 and 3 to near termen; termen

from costa to vein 3 light brownish drab preceded by a pale deeply lunular subterminal line, the lunules proximally filled in with light brownish drab; a terminal fine dusky brown line on interspaces. Hind wing thinly scaled, the space below cell and vein 6 light brownish drab, the costa above vein 6 white irrorated with some dark scales; a fine postmedial line angled below vein 7, then faint and inbent to middle of inner margin, the subterminal line faint, deeply lunular, reaching inner margin. Wings below thinly scaled, somewhat iridescent, pale drab, the veins dark; traces of the postmedial line on both wings, also faint dark spots at end of cells; the subterminal lines also indicated.

Expanse 68 mm.

Habitat.—Rio Tapajoz, Amazons.

Type.—Cat. No. 34572, U.S. N. M.

From the Dognin Collection.

Unlike any of the described species.

Euglyphis tirmina, sp. n.

Male.—Palpi fuscous, tipped with light buff. Head, collar, and thorax greyish olive, mottled with pale ecru-drab hairs. Abdomen brownish drab, darker dorsally. Fore wing silvery white; hair-brown suffusions at base of costa and cell, not quite reaching the small fuscous spot at end of cell, crossed by an antemedial white line and very irregular terminally; base of inner margin vinaceous-fawn; postmedial line faint, minutely dentate, outcurved at costa; apex and termen narrowly wood-brown, proximally edged by a fine blackish line, outcurved from costa, inangled above vein 5. Hind wing brownish drab with buffy-brown suffusions along inner margin; costal margin above vein 6 like fore wing with scattered cinnamon-brown scales, a dark medial line and a fine subterminal line, lunular below vein 6 to anal angle. Wings below avellaneous brown with terminal darker streaks on interspaces; costal edge of fore wing finely pinkish buff; the hind wing with the dark medial line on costa followed by whitish scaling.

Expanse 40 mm.

Habitat.—Colombia.

Type.—Cat. No. 34595, U.S. N. M.

From the Dognin Collection, collected by Fassl.

Euglyphis agdara, sp. n.

Male.—Antenna cinnamon-buff; body hair-brown. Fore wing vinaceous-drab; small black spots at base of costa and below cell; a fuscous streak on discocellular; a faintly paler antemedial fascia, and a postmedial similar fascia; a subterminal sinuous darker line outcurved on costa. Hind wing pale vinaceous-drab, the inner margin from below cell benzo-brown to the subterminal line which is faintly indicated. Wings below pale brownish drab, with darker suffusions on costal margins of both wings; the hind wing with a faint medial fascia.

Female.—Body brownish drab. Wings light brownish drab. Fore wing: some darker scaling at base; a faint paler antemedial fascia; a dark streak on discocellular; a drab-white postmedial fascia, outangled on costa, inbent to inner margin; a dark subterminal line outcurved on costa, the termen paler on interspaces. Hind wing similar with the postmedial fascia continued to middle of inner margin.

Expanse, male 39 mm., female, 61 mm.

Habitat.—Blumenau, Sta. Catharina.

Type.—Cat. No. 34593, U.S. N. M.

The male received from F. Hoffmann, the female from Pohl.

Euglyphis terasita, sp. n.

Male.—Head, thorax, and anal segment of abdomen white mixed with a few mouse-grey hairs, the abdomen otherwise fawn-colour with dorsal hair-brown tufts at base. Fore wing white; base irrorated with darker scales from base to antemedial line; a cinnamon spot at base of inner margin; antemedial line almost medial, fine, black, outangled on costa, and at base of vein 4, inangled on vein 2 and again outangled on vein 1; postmedial line outcurved below costa with projecting short black lines on veins, incurved below vein 7, indistinct and sinuous to inner margin; subterminal line fine, sharply outcurved from costa, incurved and dentate between veins 6 and 4, then slightly outcurved; veins on termen black. Hind wing: base tawny-olive, becoming sayal-brown below vein 7 and along inner margin to subterminal line; outer portion of costa and above vein 4 like fore wing; a double sinuous dark postmedial

slightly irregular; veins on termen black. Wings below cinnamon-buff, the termen whitish, the fore wing with the postmedial, as a shade, and the subterminal indicated, the hind wing with the postmedial line more pronounced and the subterminal as above, also an army-brown streak along inner margin.

Expanse 45 mm.

Habitat.—Yahuarmaya, Peru.

Type.—Cat. No. 34563, U.S. N. M.

Euglyphis petronella, sp. n.

Male.—Head collar, and anal segment of abdomen light brownish drab; patagia and thorax drab-grey; abdomen to anal segment light cinnamon-drab. Fore wing white, partly suffused with pallid mouse-grey; dark lines on veins at base; antemedial line almost medial, fine, double, outangled on veins 6 and 5, single and indistinct to inner margin; postmedial line outangled, lunular dentate, double on costa; subterminal line outcurved at costa, fine, slightly sinuous; veins terminally black. Hind wing from base below cell, and vein 4 to subterminal line fawn-colour; costal margin and termen to vein 3 like fore wing; a fine double postmedial line from costa to vein 3 almost vertical; subterminal line parallel with termen; veins terminally black. Wings below mostly cinnamon-buff; subterminal dark line present; cilia with white spots, the subterminal line present.

Expanse 33 mm.

Habitat.—São Paulo de Olivença, Amazons.

Type.—Cat. No. 34564, U.S. N. M.

Very similar to *E. terasita* Schs. The body is quite differently coloured; the hind wing below has no white space at apex.

Allied to *E. teresina* Schs. and *E. terasita* Schs.

Euglyphis resina, sp. n.

Male.—Head and thorax drab, the collar tipped with white hairs dorsally; abdomen vinaceous-fawn with dorsal short buffy-brown hairs at base, and similar transverse bands. Fore wing: base to medial line mostly wood-brown with fuscous irrorations crossed by a dentate outcurved whitish line from costa to median

vein, edged on either side with fuscous lines; the medial line outbent on costa, inbent to vein 5, followed by dull whitish spots, which are distally edged by the postmedial line, this line outcurved on costa, curved and inbent to inner margin, lunular, mostly double filled in with dull white; terminal space mostly dull white, crossed by the subterminal line which is drab, somewhat dentate, expanded between veins 6 and 5 with projecting streaks on veins to cilia; a faint terminal line. Hind wings mostly cinnamon-buff, darker along inner margin; costa terminally to vein 6 like fore wing; subterminal line sinuous, becoming lunular below vein 5 to anal angle; termen whitish, consisting of large round spots formed by the dark lines on veins. Wings below vinaceous-buff, the inner margin of hind wing suffused with light pinkish cinnamon; subterminal line on both wings indicated, also the pale marginal spots on both wings.

Expanse 42 mm.

Habitat.—Yahuarmayo, Peru.

Type.—Cat. No. 34569, U.S. N. M.

Euglyphis coda, sp. n.

Male.—Head whitish grey; collar fuscous, tipped with silvery white; thorax fuscous; abdomen vinaceous-fawn with dorsal fuscous spots on basal half, the terminal half light vinaceous-fawn. Fore wing largely pale vinaceous-buff; a pinkish-cinnamon streak at base of inner margin, the base above it white with some light cinnamon-drab spots on costa and a very fine lunular subbasal line, the whole limited by the very irregular antemedial line, which is inbent, excurved in cell, forming a lunule from cell to inner margin; medial line approximated to and parallel with the antemedial; medial space to postmedial with darker suffusions, the line itself incurved opposite cell, lunular dentate below it to middle of inner margin; fuscous streaks on costa at apex with buffy brown between them; subterminal line fine and very sinuous; the termen with dark lines on veins. Hind wing pale vinaceous-fawn to subterminal line; costal margin whitish crossed by a dentate medial black line; a dark spot beyond it; the subterminal line fuscous, inangled below vein 6, downbent to vein 4, then finer and inbent to inner margin; the termen pale

vinaceous-buff cut by the dark veins. Wings below pale pinkish cinnamon suffused with light vinaceous-cinnamon on inner half of hind wing, on which the costal margin is pinkish buff; the fore wing with traces of medial and postmedial lines, more pronounced on costa; the hind wing with traces of the medial and submedial lines, but the veins terminally without dark lines.

Expanse 35 mm.

Habitat.—Codajias, Amazons.

Type.—Cat. No. 34570, U.S. N. M.

From Dognin Collection.

Euglyphis medinensis, sp. n.

Male.—Head pinkish buff; collar and thorax laterally pinkish white mottled with fine dark streaks; from collar dorsally a black line on thorax to abdomen, broken on basal third of abdomen as hairy tufts, the abdomen terminally vinaceous-fawn. Fore wing largely light cinnamon-drab, thickly irrorated with dark scales; base of wing light pinkish cinnamon, basally edged by an excurved dark line, distally by a double oblique black line from cell to vein 1, above cell extending somewhat on costa; a double fuscous dentate postmedial line from vein 5 inbent to inner margin filled in with dull pinkish cinnamon, and followed by a similar shade to subterminal line, the latter outcurved from costa, expanding between veins 6 and 5, lunular from vein 5 to inner margin; the veins terminally black; pinkish-white spots on cilia at veins. Hind wing: base of costa light pinkish cinnamon; a broad fuscous shade at apex to termen at veins 8-6; inner margin broadly buckthorn-brown; a subterminal lunular drab line forming marginal vinaceous-buff spots; a fine dark terminal line with pinkish-white points at veins. Wings below pale vinaceous-fawn. Fore wing: a subterminal fuscous line from apex to vein 6 and dull light drab suffusions on interspaces. Hind wing below with basal half of costa and inner margin light pinkish cinnamon, some dark suffusions at apex and a faint subterminal line; cilia fuscous with the light points at veins.

Expanse 32 mm.

Habitat.—Medina, Colombia.

Type.—Cat. No. 34558, U.S. N. M.

Received with Dognin Collection.

The specimen was collected by Fassl.

Euglyphis xingua, sp. n.

Male.—Head and thorax cinnamon-drab; two fuscous lines from vertex across collar. Abdomen cinnamon-drab with some brown hairs dorsally at base. Fore wing cinnamon-drab at base, and broadly on termen; a medial space on costa whitish mottled with small dark scales, the medial space below it to inner margin drab thickly irrorated with darker scales, the whole limited by the postmedial line, which is fine, fuscous, outbent on costa and deeply dentate, below vein 5 lunular and vertical to vein 1; postmedial line fuscous, deeply dentate to vein 3; antemedial line dentate below costa; dark streaks on veins terminally. Hind wing buckthorn-brown, the apical space from middle of costa and on termen to vein 5 white, proximally edged by a sinuous, outbent, black line closely followed by a short cinnamon-drab line below costa and a black subterminal line; a fine sinuous terminal line. Wings below vinaceous-fawn with traces of the subterminal; medial space of fore wing suffused with cinnamon-drab.

Expanse 35 mm.

Habitat.—Ponte Nova, Rio Xingu, Amazons.

Type.—Cat. No. 34559, U.S. N. M.

Received with Dognin Collection.

Allied to *E. napala* Schs. and *E. insuta* Draudt.

Euglyphis manaosa, sp. n.

Male.—Body dull cinnamon; two basal segments of abdomen with fuscous dorsal spots, the other segments with transverse narrow cinnamon-buff lines. Fore wing to subterminal line whitish grey with some dark irrorations, except a dull cinnamon shade at base, extending slightly on costa and inner margin; a fine dark antemedial, almost medial line, outbent on costa, curved and lunular to inner margin; postmedial line fine, black, outangled on costa, dentate to vein 5, then lunular to inner margin, with projecting short black streaks basad on veins; subterminal line fine, fuscous, outcurved on costa, lunular to vein 6, then deeply dentate; the termen light cinnamon-drab, the veins with dark lines, expanding into spots on cilia. Hind wing mostly fawn-colour,

the inner margin with pale pinkish-cinnamon hairs; costal margin from near base and on termen to vein 5, white almost obliterated by the dark postmedial, intermedial, and terminal lines, this latter line continuous to inner margin with projecting streaks on veins 4-2. Wings below pale vinaceous-fawn; traces of the subterminal line, which is only minutely dentate; hind wing with traces of a fine postmedial and subterminal line on costa.

Expanse 35 mm.

Habitat.—Manaos, Amazons.

Type.—Cat. No. 34567, U.S. N. M.

From the Dognin Collection.

Allied to *E. xingua* Schs.

Euglyphis campinata, sp. n.

Female.—Head and thorax drab-grey. Abdomen cinnamon-fawn. Fore wing pale ecru-drab, thickly irrorated with drab and white scales; an oblique fuscous line from base of costa to below cell; antemedial line fine, hair-brown, preceded and followed by a fine dark line on costa, slightly outcurved, then excurved below vein 2; a black point at end of cell; postmedial line fine, hair-brown, slightly outbent on costa, minutely dentate, lunular below vein 4, more heavily marked on inner margin; subterminal line similar, incurved between veins 5 and 4, forming a lunule on inner margin; cilia light drab with small pinkish-buff spots. Hind wing light cinnamon-drab from base below cell to inner margin and termen; an antemedial cinnamon-drab broad line; costa and termen to vein 4 like fore wing; a subterminal macular darker shade. Wings below avellaneous, the subterminal line as above; an irregular medial dark shade on fore wing; on hind wing a dark medial spot on costa.

Expanse 39 mm.

Habitat.—Campo Bello, Prov. of Rio.

Type.—Cat. No. 34560, U.S. N. M.

Several specimens received from J. F. Zikan.

Euglyphis cachaca, sp. n.

Female.—Head and thorax light mouse-grey thickly mottled with darker hairs; collar greyish olive; abdomen cinnamon-drab on basal half with a small darker dorsal

tuft at base, the terminal half drab, the anal segment greyish. Fore wing drab-grey, thickly mottled with white and black scales, giving it a greyish tinge; some light cinnamon-drab scaling at base of inner margin; antemedial line very faint, double, dark mouse-grey, outbent on costa, incurved in cell, then inbent, sinuous to inner margin, enclosing small annuli; a black line on discocellular; postmedial line fine, dentate, outbent on costa, slightly inbent to inner margin, distally edged with pale drab-grey, closely followed by a drab-grey narrow shade, which is more pronounced at costa, forming an acute angle; subterminal line very fine and indistinct, incurved opposite cell, then lunular dentate; cilia with fuscous spots on interspaces. Hind wing light cinnamon-drab from base and below vein 4 to subterminal line; costa and termen above vein 4 like fore wing, also the distal edging of the subterminal dark line; a postmedial dark line on costa, distally edged with white; cilia deep brownish drab tipped with vinaceous-fawn. Wings below drab without lines.

Expanse 51 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34579, U.S. N. M.

Near *E. campinata* Schs.

Euglyphis mulieraria, sp. n.

Female.—Head and thorax mottled whitish and cinnamon hairs; abdomen vinaceous-fawn above, darker underneath. Fore wing like thorax; base of costa cinnamon-drab, the lines and termen russet; antemedial line fine, double from costa to median vein, single below cell, then vertical; a fuscous point at end of cell; postmedial line double and outbent on costa, curved and inbent to vein 5, below it single and lunular to inner margin, distally narrowly edged with white; subterminal line parallel with postmedial from costa to vein 8, then minutely dentate; tips of veins on termen benzo-brown. Hind wing buckthorn-brown; a dark medial line from costa; apical half of costa from medial line and vein 3 whitish with a postmedial drab shade; a subterminal fine fuscous line from costa to vein 3. Wings below cinnamon-drab, the postmedial line on hind wing indicated.

Expanse 47 mm.

Habitat.—Campo Bello, Prov. of Rio.

Type.—Cat. No. 34561, U.S. N. M.

Euglyphis cochabamba, sp. n.

Male.—Head, collar, and patagia light mouse-grey mottled with darker scales, the collar medially with some still darker hairs; the thorax, almost completely covered by the patagia, and the abdomen wood-brown, with darker transverse lines, the latter with dorsal fuscous tufts at base. Fore wing dull vinaceous-buff irrorated with light drab, the lines black; some vinaceous-fawn at base of inner margin; antemedial and medial lines close together, parallel, outcurved on costa, then wavyly inbent to inner margin; a black point at end of cell; postmedial line outbent on costa, angled and wavyly inbent to vein 5, then lunular to inner margin, distally edged with white on costa and from vein 5 to inner margin, the white also followed by some darker shading; the subterminal line fine, outbent on costa, angled and slightly wavy and parallel with termen to vein 6, deeply incurved to vein 4 and sinuous to inner margin; veins terminally with black streaks. Hind wing avellaneous, somewhat darker along inner margin; apex with fuscous suffusions; the fuscous subterminal line sinuous to vein 4 then lunular to inner margin with dark lines to termen. Wings below vinaceous-fawn with subterminal line indicated; cilia with small white spots at veins.

Expanse 43 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34571, U.S. N. M.

Collected by J. Steinbach.

Two males in collection. Closely allied to *E. gorda* Dognin.

Euglyphis huacamaya, sp. n.

Male.—Head, thorax, and anal hairs white mottled with mouse-grey hairs; abdomen cinnamon-drab with small fuscous tufts dorsally on three basal segments. Fore wing: base on inner margin vinaceous-pink crossed by a fine dark subbasal line, above it on costa and below cell some whitish-grey scaling followed by some cinnamon-buff, the whole limited by a double black outcurved antemedial line, inangled on vein 1; costal margin largely

cinnamon-buff crossed by the dark lines; medial and postmedial space largely hair-brown; the postmedial line almost obliterated by the ground-colour, defined on inner margin by some vinaceous-buff scaling; the subterminal line very fine and slightly dentate from vein 9 to vein 6, inbent and excurved between veins 6 and 5, then outcurved to vein 3, inwardly edged with white between veins 8 and 6, more so between veins 5 and 3; termen with white spots on interspaces, separated by the dark veins. Hind wing tawny-olive suffused with pinkish cinnamon; outer half of costa and termen to vein 6, crossed by a double fuscous line and a sinuous black subterminal line, below vein 6 with projecting streak on veins forming marginal spots to anal angle. Wings below vinaceous-fawn; traces of subterminal line on fore wing, this line on hind wing macular.

Expanse 37 mm.

Habitat.—La Union, Rio Huacamaya, Peru.

Type.—Cat. No. 34568, U.S. N. M.

From the Dognin Collection.

Allied to *E. congruens* Dognin.

[To be continued.]

V.—*A Collection of Reptiles and Amphibians from the Mountains of British New Guinea.* By H. W. PARKER, B.A., Department of Zoology, British Museum (Natural History).

DURING her recent expedition into the mountains of British New Guinea Miss L. E. Cheesman collected a very fine series of reptiles and amphibians, representing some fifty species, of which no less than six appear to be new to science. This extraordinarily high percentage of undescribed forms is indicative of the present state of knowledge of the herpetological fauna of the region, and so meagre and unsatisfactory is our knowledge of even the described species that in many instances each additional specimen that comes to hand increases rather than diminishes the systematists' perplexity. The following notes indicate some of the problems raised by the present collection.

The author is indebted to Miss Cheesman not only for the privilege of examining the material but for the notes on the habits of some of the species and for much valuable information concerning the places in which the collection was made. Maps of the region are, for the most part, very unsatisfactory, so that the following details of the localities mentioned below may not be out of place.

Kokoda : 15 miles east of Mount Victoria.

Orrori : in the Owen Stanley range about 10 miles S.W. of Kokoda.

Mafulu : $8^{\circ} 33' \text{ S.} \times 147^{\circ} \text{ E.}$

Mondo : 9 miles S.E. of Mafulu.

Mt. Tafa : 5 miles S.E. of Mondo.

The first two localities are in the eastern drainage, and the last three lie to the west of the main range of mountains. Although the distances between them are small, there are frequently mountains of considerable altitude intervening, so that the actual distance in miles may indicate a geographical proximity which is not accompanied by faunal resemblance of the degree that might be expected.

Many of the comparisons which were necessary for the determination of the material could not have been made without the generous assistance of Professor L. F. de Beaufort of Amsterdam and Dr. L. D. Brongersma of Leiden, to both of whom the author tenders his thanks.

AMPHIBIA.

ANURA.

Ranidæ.

Rana rugata van Kampen.

12 ♂♂, ♀♀, Kokoda, 1200 ft.

This is a terrestrial species found among the dead leaves of the forest floor or in holes in the ground. It is known to the natives as "Tamba" or "Oo-go," and the croak is a long drawn out "Ak-ak-k-k-k."

Rana papua Lesson.

48 ♂♂, ♀♀, and juveniles ; 35 tadpoles from Kokoda, 1200 ft.

8 ♂♂, ♀♀, and juveniles ; from Mafulu, 4000 ft.

It seems probable that several species have in the past been confused under this name. One of them is a larger, broader-headed form, which is probably referable to *Rana grisea* van Kampen (q. v.), and the adults of the two may be distinguished as follows:—

- A. Distance between the dorso-lateral folds on the occiput scarcely, if at all, greater than the distance between the nostril and the posterior corner of the eye; tympanum more than half the diameter of the latter, and separated from it by a distance scarcely more than half its own horizontal diameter. Toes frequently less than fully webbed. Maximum size, ♂♂ 66 mm., ♀♀ 86 mm. *R. papua*.
- B. Distance between the dorso-lateral folds on the occiput as great as the distance from the nostril to the tympanum; in females the latter is only half the diameter of the eye, but separated from it by a distance nearly equal to its own horizontal diameter. Toes always fully webbed. Largest ♂ 80 mm., ♀ 120 mm. *R. grisea*.

Specimens 9, 10, 20, 21, 22, 23, 25, 26, and 27, recorded by Boulenger (1920, p. 189) as *R. papua*, appear to be really *R. grisea*, and the last-mentioned of the three examples referred to the latter species (*op. cit.* p. 186) is *R. papua*.

Existing descriptions of the tadpole of this species (van Kampen, 1906; *idem* 1914; van Kampen and Brongersma, 1931; van Kampen, 1923, p. 202; Roux, 1910, p. 225) also indicate either an enormous range of variation, or, more probably, specific confusion. Those from the Jamūr River, the Sekanto region, and Sentani Lake, which were first described (van Kampen, 1906), have the labial teeth in series 3/3 or 4/3 and have a series of dermal glands which were overlooked by the original describer. Of these the most important are a large oblique pair on the ventral surface just in front of the hind limbs; they are constantly present, and even persist in the metamorphosing froglet. Other glands on the ventral surface are a widely separated pair just behind the mouth, and dorsally there is always a small, black-pigmented, glandular area in the "paratoid" region; older examples sometimes have a small dorso-lateral patch just anterior to the inguinal region.

The tadpoles from "Hollandia" described by van Kampen in 1914, and those from Sumba mentioned by van Kampen and Brongersma (1931), have the labial

teeth in series 2/3 or 3/3 and lack all trace of the large ventral glands in front of the legs, but have a large dorso-lateral gland on each side which extends from a short distance behind the eye almost to the groin. The adult frog associated with these series is a small, very acute-snouted animal, undoubtedly of the *Rana papua* complex, but possibly representing an undescribed species. Parenthetically it may be remarked that the "Hollandia" series also contained many tadpoles of some species of *Hyla*, but as these were not used in drawing up the descriptions no questions of synonymy become involved.

The tadpoles from Kokoda and Mafulu listed above as *R. papua* agree in most points with those first described under this name (van Kampen, 1906), for they have the ventral glands, but there are some minor differences which may indicate geographical rather than specific variation. A description of a well-developed tadpole is :—

Body once and a half as long as broad ; tail acutely pointed, 2·6 times as long as the body and 3·7 times as long as deep. Nostrils twice as far from a line joining the anterior corners of the eyes as from the tip of the snout. Spiraculum sinistral ; eyes supero-lateral, about midway between the tip of the snout and the spiraculum ; interocular space a little greater than the internarial ; anus dextral, opening behind the posterior borders of the thighs at the level of the edge of the lower caudal crest. Upper caudal crest once and a half as deep as the lower. Mouth bordered laterally and posteriorly by a continuous row of papillæ, arranged in three or four series at the corners and in one or two behind. Labial teeth in four or five series above and three below the mouth ; the outermost of the upper series is long and continuous, but the remaining upper series are widely interrupted mesially and their length decreases progressively inwards ; the three lower series are subequal in length, the innermost alone being very narrowly interrupted mesially. Body with a series of glandular patches as follows :—A small black-pigmented one above each eye ; another similar larger one behind each eye, and a third on each side elongate and extending from the postorbital patch to the groin. These dorso-lateral patches are not developed in specimens without hind limbs, and in older examples they fuse to form a continuous

band which, at metamorphosis, gives rise to the dorso-lateral glandular fold of the frog. Ventrally there is a large, oval, oblique glandular patch in front of each groin; this area increases in size with age, but unlike the dorsal patches is only feebly pigmented.

Dark grey above, with the glandular areas black; lower surfaces lighter. Tail white except for a narrow black line on the upper edge of its muscular part and extending to its extreme tip.

At metamorphosis the dark dorso-lateral streak persists for a time, so that the flanks of very young frogs below the dorso-lateral fold are black from the eye to the groin; subsequently the posterior part of this zone loses its black pigment and a dark temporal spot alone persists.

Newly metamorphosed frogs measure about 16–22 mm. from snout to vent and differ from the adults in having a slightly broader head and in the first finger being no longer than the second; but the first digit rapidly increases and soon attains the adult proportions, whilst the head increases in length also.

This species is known to the natives as “Barka” or “Karna.” It is common in the streams, and croaks continuously night and day during May and June; later in the year the call is given only intermittently, but more especially on thundery evenings. The note is a querulous long-drawn-out croak, like that of a rusty hinge. The larvæ were observed browsing on the algæ covering stones at the margins of the streams.

Rana grisea van Kampen.

Rana papua (part.), Boulenger, 1920, Rec. Ind. Mus. xx. p. 180.

2 ♂♂, 2 larvæ, Mafulu, 4000 ft.

2 ♀♀, Mondo, 5000 ft.

♀, 2 larvæ, Kokoda, 1200 ft.

As mentioned above, this species appears to be easily confused with *R. papua*. Thanks to the kindness of Prof. de Beaufort it has been possible to compare this series with the type of *R. grisea*. They have the same broad head which appears to be characteristic of the species, but the two examples from Mondo have a rather shorter, blunter snout. The Kokoda female is the largest recorded, measuring 120 mm. from snout to vent.

The identification of the tadpoles listed above must be considered doubtful; they obviously represent some frog very closely allied to *R. papua*, for they have ventral glands like the tadpole of that species, but there is no certain indication that they are really referable to *R. grisea*.

The habitus and general proportions are similar to the foregoing tadpole of *R. papua*, but there are differences in dentition, the disposition of the dermal glands, and colour. The labial teeth are in series 3/3, the two innermost of the upper jaw widely divided in the middle. The dermal glands are a small pair just behind the mouth; a large circular pair in front of the hind limbs, another pair situated dorso-laterally immediately above the latter, and another dorso-lateral pair about the middle of the body. The secretion of these glands is a rusty-orange in colour. In specimens without limb rudiments glands are not developed, but in an example about to metamorphose the dorso-lateral and ventral inguinals are so large that they form one continuous whole. The head and body are blackish above and white beneath, whilst the upper caudal crest and muscular part of the tail are white, with regular small round black spots.

Rana arfaki Meyer.

8 ♂♂, ♀♀, and juvs., Kokoda, 1200 ft.

♂, Mafulu, 4000 ft.

Whilst all these specimens fall within the limits of variation in existing descriptions of *Rana arfaki*, it seems possible that they really represent two distinct species. In the original description of *R. arfaki* the tympanum is said to be fully half the diameter of the eye, and in the type of *macroscelis*, generally regarded as a synonym of the former, the tympanum has the same proportions. The Mafulu specimen agrees well with the type of *macroscelis*, but in the Kokoda series the tympanum is much smaller—instead of being more than half the diameter of the eye and longer than its distance from the latter, its diameter is less than half that of the eye and appreciably less than its distance from the orbit. The type of *Rana waigeënsis* van Kampen, hitherto placed as a synonym of *Rana arfaki*, has the same small tympanum, and agrees very closely with the juveniles of the Kokoda series; but even

if it could be shown that there really are two distinct species, the name *waigeënsis* van Kampen cannot be used, since it is a homonym of *Rana* [*Limnodytes*] *waigiensis* (Dum. & Bibr.) (van Kampen, 1922, p. 204). But in the present uncertain state of our knowledge it does not seem advisable to propose a new name until more is known of the limits of variation of the numerous species of *Rana* which are to be found in New Guinea.

Natives report that the males of the species (Kokoda) excavate basins in the beds of shallow streams; they remain in these basins with the head just above water, calling "Ka-ha, ka-ha." Pairing and oviposition occur at night in these "nests." By day the species is often found in the axils of the branches of trees a short distance from the ground. The native name is "ka-ha."

Microhylidæ.

Sphenophryne rhododactyla (Boulenger).

♂, Mt. Tafa, 8500 ft.

This example agrees well with the only other known specimens, the types, in morphological characters, but differs in the colour of the fingers and toes. These, instead of being red or white as they were said to be in the types, are dark brown, with minute light specklings like the rest of the limbs. The types are undoubtedly partially bleached, and the apparent colour of the digits may be due to this post-mortem change.

Oreophryne biroï (Méhely).

♀, Mt. Tafa, 8700 ft.

2 ♀♀, 1 juv., Kokoda, 1200 ft.

♀, Orrori, 3000 ft.

Cophixalus cheesmanæ Parker.

♂, ♀, Kokoda, 1200 ft. *Types*.

Asterophrys doriæ (Boul.).

3 ♀♀, 2 ♂♂, Mondo, 5000 ft.

In this series the ventral surfaces are dark bluish grey relieved by white dots; the yellow markings of the tibiæ, femora, and groins are greatly reduced in size, especially on the tibiæ and behind the thighs.

Asterophrys rufescens (Macleay).

♀, Mafulu, 4000 ft.

♂♀, Kokoda, 1200 ft.

Asterophrys valvifera (Barbour).

♀, Mafulu, 4000 ft.

This single example, if correctly identified, extends the known range of the species considerably. It agrees well with topotypic material, though the legs are a trifle longer and the lower surfaces somewhat darker, being pale brown with obscure mottlings, especially on the chin and throat.

Metopostira ocellata Méhely.

♂, Kokoda, 1200 ft.

BARYGENYS, gen. nov.

In a recent review of the family Microhylidæ the author (1934, p. 68) grouped the species *ocellata* Méhely, *kopsteini* Mertens, and *atra* Günther into a single genus, *Metopostira*. At the same time it was pointed out that the first two of these species, long-legged "grass-frogs," had very little in common superficially with the globose, burrowing, third species, but that, since in the allied genus *Asterophrys* a complete gradational series could be traced between similar extremes, future discoveries might reveal the intermediates in *Metopostira*. But Miss Cheesman has discovered a new frog very closely allied to *M. atra*, and since fifteen examples are available it has now been possible to make a more complete osteological examination. This reveals differences between the type-species of *Metopostira* (*M. ocellata*) and the two burrowing species which seem to show that both the latter should be referred to a distinct genus. No old generic name is available, so that this new group may be known as *Barygenys*, with *B. cheesmanæ* as type-species. The generic diagnosis is:—

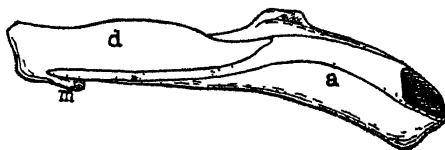
Maxillæ not meeting in front of the premaxillæ and not overlapping; dentaries massive, forming a median suture and fused with the mento-meckelian bones (fig. 1); prevomer large, undivided, in contact with its fellow mesially, the post-choanal portion overlying the palatine region, but without odontoids. Clavicles, p. ocoracoids,

and omosternum absent; sternum cartilaginous. Vertebral column diplasio-cœlous. Terminal phalanges T-shaped.

Pupil horizontal. Tongue large, subcircular, almost entirely adherent behind, and with a median longitudinal furrow. A denticulated dermal ridge across the palate in front of the pharynx, preceded by a shorter one. Digits free, with or without traces of terminal dilatations.

This genus differs from *Metopostira* in the meeting of the dentaries and their fusion with the mento-meckelian bones, and in the fact that the maxillaries do not overlap the premaxillaries. The condition of the lower jaw is similar to that found in *Asterophrys*, though in the latter the mento-meckelians are larger. In the subfamily *Asterophryinæ* various stages in rendering the jaw more rigid can be traced; the most advanced stage is shown by *Xenobatrachus* and *Asterophrys*, where the maxillæ and

Fig. 1.



Left ramus of mandible of *Barygenys cheesmanæ*, gen. et sp. n.
a=angular; d=dentary; m=mento-meckelian rudiment.

dentaries meet and form a median suture in front of the premaxillæ and mento-meckelians respectively. *Genophryne* and *Metopostira* show a less advanced condition where the maxillæ and dentaries overlap the other elements in front, but fail to meet. *Barygenys* shows the same advanced condition of the mandible as *Xenobatrachus* and *Asterophrys*, but the maxillary condition is the most primitive within the subfamily.

Barygenys cheesmanæ, sp. n.

Holotype a ♂, number 1935.3.9.125. in the British Museum, from Mt. Tafa (8500 ft.), Papua; collected by Miss L. E. Cheesman in February 1934.

Habitus globose. Snout pointed, prominent, nearly twice as long as the very small eye; nostril very slightly nearer the eye than the tip of the snout; no canthus rostralis; loreal region very oblique, convex; inter-

orbital space three times as wide as the upper eyelid ; tympanum hidden. Fingers very short, tapering and depressed, without terminal dilatations, the first much shorter than the second, which is about equal to the fourth. Toes very short, depressed, slightly spatulate distally ; the inner almost vestigial and the outer shorter than the third. No defined subarticular tubercles, but traces of an inner metacarpal and inner metatarsal tubercle. Hind limb very short ; on account of the globose habitus it cannot be laid forwards, but its length from the anus to the tip of the fourth toe with the leg at right angles to the vertebral column equals the distance from the anus to the posterior corner of the eye ; length of the tibia contained four times in the distance from snout to vent.

Skin smooth above, with a few small scattered pustules. A slight fold from the eye above the tympanic region ; at the tip of the snout the skin is thickened and is adorned with three vertical ridges which form a most conspicuous feature. The central ridge extends from the under surface of the snout back to the level of the nostrils ; the lateral ridges, which lie slightly mesial to the vertical of each nostril, extend as far beneath but are shorter above. Lower surfaces smooth save for a few very small pustules beneath the chin.

Pale brown above, with a few irregularly scattered dark spots. Hind limbs darker and the thickened skin of the snout with a grey tinge. Lower surfaces dirty brown with some minute white dots.

A vocal sac is present.

	mm.
Length from snout to vent	39
Hind limb.....	35

The thirteen paratypes (1935.3.9.126-138), all from the same locality, differ from the holotype scarcely at all except in colour and a tendency for the dorsal pustules to form a line on each side of the coccyx. The ground-colour varies from a brownish yellow to a deep red-brown, with more or less black spots irregularly scattered on it. Some pink spots may also be present and a reddish colour may be present on the hind limbs. The lower surfaces vary from dirty yellow to brown, and the largest example measures 40 mm. from snout to vent.

The species lives in holes in the ground on Mt. Tafa, and the call of the male, heard throughout the day, was a peculiar drumming. The native name is "Tunbera."

The species is readily distinguished from its congener *B. atra* (Günther) by its much shorter legs and the peculiar vertical ridges on the snout. In *B. atra* the hind limb is approximately once and a half as long as the head and body, and the tibia is contained less than two and a half times in the distance from snout to vent.

Hylidæ.

Hyla graminea Boulenger.

♂, Kokoda.

This, the second example of the species to be discovered, agrees well with the type in all morphological characters and in colour. It is, however, much larger, measuring 69mm. from snout to vent, and exhibits the male secondary sex-characters of the species. These consist of a subgular vocal sac opening by a long slit on each side of the tongue and a very small, oval, nuptial pad on the inner side of the first finger; there is no projecting prepollex.

In life the dorsal surfaces are green and the concealed surfaces of the femora and upper arms bright yellow. Local name "Karāoo."

Hyla infrafronata Günther.

♂, Kokoda.

This specimen was taken from the top of a newly felled 60-foot tree. Native name "Pára-pára."

NYCTIMYSTES Stejneger.

The generic status of the Papuan Hylids with a vertical pupil is a matter of controversy. Originally they were referred to *Nyctimantis*, a South American genus, by Boulenger (1897, 1914), but Stejneger (1916) refused to believe that the Papuan and Neotropical species could be at all closely related, and proposed the name *Nyctimystes* for the former. The latest commentator, Noble (1931, p. 513), points out that a vertical pupil appears several times in different sections of the family Hylidæ, and since the only two Papuan species known at that time were markedly different he suspected that they were not closely allied, but represented two parallel evolutionary developments; consequently the genus *Nyctimystes* was

rejected as a heterogeneous assemblage. But the material in the present collection makes it very evident that there are many more vertical-pupilled Hyliids in New Guinea than was previously realized, and that these species are really closely allied and form a natural genus.

The various species which are recognizable at present may be distinguished thus :—

- I. Outer fingers not more than $\frac{1}{2}$ webbed (fig. 2). Snout short, rounded, as long as the eye, distance between the anterior corners of the eyes much longer than the snout.
 - A. Lores almost vertical; metatarsals with rows of small tubercles; a small tubercle on the heel present or absent; lower eyelid without or with only a rudimentary metallic venation. Male without a vocal sac *N. papua* (Boul).
 - B. Lores more oblique; metatarsals without rows of tubercles, no tubercle on the heel; a well-developed palpebral venation. Male with a vocal sac *N. gularis*, sp. n.
- II Outer fingers $\frac{1}{2}$ webbed (fig. 3).
 - A. Snout about as long as the eye, high, with vertical lores, distance between the anterior corners of the eyes much longer than the snout, no papilla on the heel. A palpebral reticulum. Size large *N. granis* (Boul.).
 - B. Snout longer than the eye, depressed, with oblique lores, distance between the anterior corners of the eyes a little longer than the snout. A palpebral reticulum; a papilla on the heel. Male with a vocal sac *N. montana*, sp. n.
- III. Outer fingers half-webbed (fig. 5). Snout longer than the eye; a palpebral reticulum; heel with a large lappet *N. semipalmata*, sp. n.

Nyctimystes papua (Boulenger).

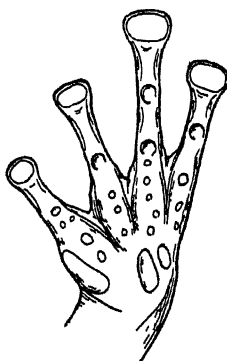
34 ♂♂ from Mondo, 5000 ft. ; collected Jan. 1934.

The co-types on which this species was founded are not all conspecific. Of the five specimens still in the British Museum four are females and one a male. The females agree with one another and with the original description and figure, but the male has a somewhat longer, flatter snout, shorter fingers, and much more digital webbing between the outer fingers. It is tentatively referred to *N. semipalmata*, sp. n. (q. v.).

The present large series of males is remarkably homogeneous in appearance, and appears to represent the true

male of *N. papua*, though the fingers are slightly shorter than in that species and the colour is rather different. In the type-females the free portion of the third finger (measured along its mesial side from the lowest point of the web between the second and third) is as long as the distance from the nostril to the ear, whereas in the Mondo males the same digit is only as long as the distance from the nostril to the posterior corner of the eye. In both the co-types and the present collection the metallic venation of the lower eyelid, so characteristic of all the other species, is reduced to a few scattered dots and indefinite narrow lines. The upper surfaces, flanks, and limbs are a brownish grey, uniformly mottled with irregularly shaped dark

Fig. 2.

Hand of *Nyctimystes papua* (Boulenger).

brown or black markings. Lower surfaces pale brown or whitish anteriorly, with dark brown mottling on the chin and chest, becoming rufous-brown on the belly and beneath the hind limbs.

The secondary sex-character consists of a small, round, nuptial pad on the carpo-metacarpal joint of the first finger; there is no vocal sac. Size from 46-51 mm., mode 49 mm.

Nyctimystes gularis, sp. n.

Associated with the foregoing series of males of *N. papua* are two smaller males, very similar in morphological characters but differing in the possession of a vocal sac opening by a long slit on each side of the tongue. The

presence of this structure and their small size seems to indicate that they belong to a distinct species which does not appear to have received a name.

Holotype a male, number 1935.3.9.173 in the British Museum from Mondo, Papua (5000 ft.); collected in January 1934 by Miss L. E. Cheesman.

Tongue oval, notched and slightly free behind; vomerine teeth in two short transverse series between the choanæ. Head broader than long; snout short, blunt, as long as the diameter of the eye, with well-marked, curved canthus rostralis and moderately oblique, concave loreal region; nostril much nearer the tip of the snout than the eye; distance between the anterior corners of the eyes much greater than the length of the snout; interorbital space as broad as the upper eyelid; tympanum very small, about one-fourth the diameter of the eye. Fingers about one-quarter webbed (as in *N. papua*, fig. 2), with large discs nearly twice as wide as the tympanum; first much shorter than the second, which is shorter than the fourth; free portion of the third (on its mesial side) a little shorter than the distance from the nostril to the posterior corner of the eye. Toes nearly fully webbed, the membrane not quite reaching the discs of all except the fourth, which has the penultimate phalanx free; subarticular tubercles well developed; an oval inner, but no outer, metatarsal tubercle. Tibiotarsal articulation extending a little beyond the tip of the snout.

Skin smooth above; granular on the flanks, chin, belly, and lower surfaces of the thighs; a strong, curved supratympanic fold; faint indications of a row of tubercles on the outer edge of the fore-arm and tarsus.

Blackish olive above, very obscurely mottled, and with a faint greenish metallic sheen. Limbs obscurely cross-barred; hinder side of thighs brown, with faint lighter markings. Lower surfaces dirty brown. Lower eyelid with well-defined metallic venation. A nuptial pad extending from the carpo-metacarpal knuckle to the base of the inner metacarpal tubercle; a vocal sac opening by a long slit on each side of the tongue. Length from snout to vent 37 mm.

The paratype (B.M. 1935.3.9.174), another male from the same place, agrees essentially with the type, but has

a somewhat larger tympanum, which measures one-third the ocular diameter, and the digital discs are consequently only once and a half as broad as this structure.

Yet a third specimen is tentatively referred to this species, but it is, unfortunately, not sufficiently well preserved for certain identification. It is a female from the type-locality, which agrees with the types in morphological details but differs in colour. It is almost black above, with some brownish-white blotches on the posterior part of the back and hind limbs, and small white spots in the groin and on the flanks.

Nyctimystes montana, sp. n.

Holotype a male, number 1935.3.9.176 in the British Museum, from Mondo, Papua (5000 ft.), collected in February 1934 by Miss L. E. Cheesman.

Tongue large, oval, notched and slightly free behind; vomerine teeth in two slightly oblique groups between the large choanæ. Head broader than long; snout depressed, once and a third as long as the eye, with a well-marked canthus rostralis and distinctly oblique loreal region; nostril much nearer the end of the snout than the eye; distance between the anterior corners of the eyes a little longer than the snout; interorbital space as broad as the upper eyelid; tympanum very small, about a third the diameter of the eye. Fingers about one-third webbed (as in *N. granti*, fig. 3), with large truncate discs which are once and a half as wide as the tympanum; first much shorter than the second, which is shorter than the fourth; free portion of the third (on its mesial side) a little shorter than the distance from the nostril to the posterior corner of the eye. Toes fully webbed; sub-articular tubercles well developed; an oval inner and a minute outer, metatarsal tubercle. Tibio-tarsal articulation reaching a little beyond the tip of the snout.

Skin smooth above, granular on the belly and hinder side of the thighs; a short straight fold from the eye above the tympanum; a row of small tubercles along the outer sides of the forearm and tibia and a small papilla on the heel.

Uniform greenish grey above and white beneath; edge of upper jaw whitish but not forming a well-defined line; concealed surfaces of the hind limbs, flanks, and the

two outer toes darker blue-grey; tubercles of the forearm and tibia picked out in white. Lower eyelid with a well-defined metallic venation.

A diffuse nuptial pad on the metacarpo-phalangeal joint of the first finger extends on to the prominent inner metacarpal tubercle; a vocal sac opening by a slit on each side of the tongue. Length from snout to vent 49 mm.

Paratypes sixteen males from Kokoda (1200 ft.); numbers 1933.11.14.5-7 and 1935.3.9.177-188, 199 in the British Museum.

Fig. 3.

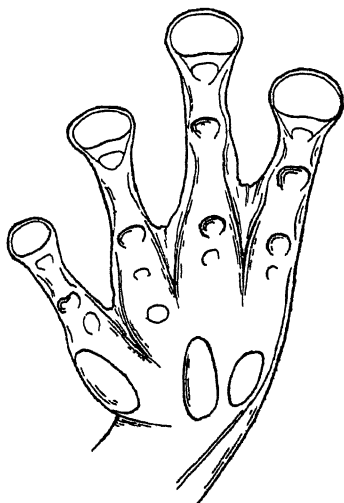


Fig. 4.

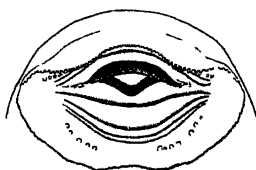


Fig. 3.—Hand of *Nyctimystes granti* (Boulenger).

Fig. 4.—Mouth-parts of tadpole of *Nyctimystes montana*, sp. n.

This long series of males agrees admirably with the type, the only differences being in colour and the texture of the skin. The latter may have some small scattered papillæ on the dorsum, and the colour of the upper surfaces varies from light greenish grey through blue-grey to brownish; usually the colour is almost uniform, but there may be some obscure mottlings or some small white spots; the tibiæ often show indefinite traces of cross-bars.

A series of nine tadpoles collected at Kokoda appear to be referable to this species. They are characterized by a very large downwardly directed suctorial mouth, such as van Kampen has described for *Hyla montana*

(1913) and *Hyla* sp. (1914, p. 370); but it seems probable that tadpoles of this type may be characteristic of all species of the present genus, for those referred to the following species also have this large suctorial mouth. Possibly van Kampen's tadpoles may be those of *Nyctimystes*, for the white dermal seams on the forearm and tarsus, as well as the papilla on the heel which caused him to refer them to *H. montana*, are also present in some species of this genus (*N. semipalmata*, q. v.).

A specimen with moderately well-developed hind limbs measures 39 mm. and has the following characters:—Body nearly once and a half as long as broad, depressed. Tail once and a half as long as the body, nearly three times as long as deep, obtusely rounded terminally; caudal crests only forming a low ridge on the anterior third of the tail. Nostrils directed vertically upwards, equidistant from the tip of the snout and a line connecting the hinder borders of the eyes. Eyes latero-superior; interorbital space twice the internarial. Spiraculum a short but prominent sinistral tube, twice as far from the snout as from the posterior end of the body. Anus median. Mouth (fig. 4) large, directed vertically downwards, nearly as wide as, and almost half as long as, the body, with a curved anterior and much expanded lower lip. The anterior bears a closely set double series of short papillæ, and the free edge of the lower lip is fringed with papillæ so small that it appears finely denticulate. The inner surface of the lower lip between its free edge and the outermost series of labial teeth bears a row of 10-14 (usually twelve) small knob-like prominences divided into two by a wide median interspace. Mandibles very thick. Two long rows of upper labial teeth, extending over almost the whole width of the mouth, and four lower; the innermost of the latter is situated close to the lower mandible, but separated by a wide interspace from the three outer; the innermost rows of both lips are stouter than the outer ones.

Upper surfaces grey, mottled with darker; muscular portion of the tail grey, dappled with white; caudal membranes with black flecks, especially towards the tip.

An example with the fore-limbs extruded measures 17 mm. from snout to vent. The proportion of the digits and the webbing is the same as in the adult.

This species is known locally as the "Tu-tu-i." It is arboreal, being found in the foliage of high trees, and the call is a clicking sound such as can be imitated by the tongue on the palate. The tadpoles were collected beneath stones in swift-flowing streams.

Nyctimystes semipalmata, sp. n.

Holotype a female, number 1935.3.9.198 in the British Museum, from Kokoda (1200 ft.).

Tongue large, subcircular, scarcely free, and slightly emarginate behind. Vomerine teeth in two slightly curved series between the choanæ. Head broader than long; snout depressed, once and a half as long as the eye, with an obtusely angular, curved canthus rostralis and

Fig. 5.

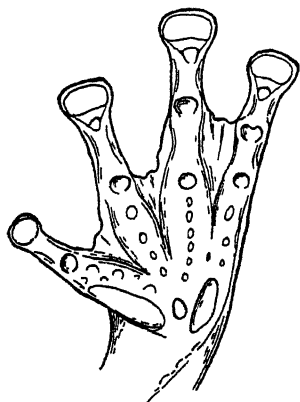


Fig. 6.

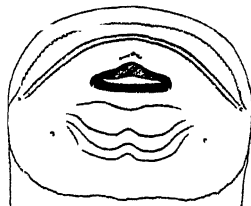


Fig. 5.—Hand of *Nyctimystes semipalmata*, sp. n.

Fig. 6.—Mouth-parts of tadpole of *Nyctimystes semipalmata*, sp. n.

oblique, concave loreal region; nostril twice as far from the eye as from the tip of the snout; distance between the anterior corners of the eyes distinctly greater than the length of the snout; interorbital space as broad as the upper eyelid; tympanum small, a little less than half the diameter of the eye. Fingers about half-webbed (fig. 5), with discs once and a half as wide as the tympanum is high; first much shorter than the second, which is a little shorter than the fourth. Toes webbed to the discs; subarticular tubercles prominent; a small

oval inner but no outer metatarsal tubercle. Tibio-tarsal articulation reaching the level of the tip of the snout.

Skin smooth above and granular below and on the lower surface of the thighs; a curved supratympanic fold; a crenulate dermal ridge along the outer edge of the fore-arm and a similar but less distinct one along the tibia, culminating in a triangular lappet on the heel.

Pinkish grey on the upper surfaces of the head, body, fore-arms, outer two fingers, tibiae, tarsi, and outer two toes, with a regular stippling of small circular black dots. The reddish tinge is most marked on the snout and digits and the stippling denser on the anterior part of the head. Femora, upper arms, and inner digits greenish grey, the femora with small, pale brown blotches. Lower surfaces greenish white. The dermal folds on the fore-arm and tarsus are faintly touched with white. Lower eyelid with a well-marked golden venation. Length from snout to vent 59 mm.

The male co-type of *N. papua* (q. v.) is also tentatively referred to this species. It differs from the female in its smaller size (40 mm.), slightly less webbing between the fingers, and much less profuse black stippling; the ground-colour of the lower surfaces, inner digits, and femora is also brownish rather than greenish. It has a vocal sac and a nuptial asperity on the metacarpophalangeal knuckle of the first finger.

An advanced tadpole and a metamorphosing froglet collected at Kokoda are also referred to this species provisionally; both have a vertical pupil, a large lappet on the heel, distinct dermal ridge on fore-arm and tarsus, and the webbing between the fingers is slightly greater than in the tadpoles of the preceding form, though not so extensive as in the adult female.

The tadpole, which measures 27 mm. from the tip of the snout to the hinder side of the thighs, has a body twice as long as broad and an obtusely pointed tail 1.3 times as long as the body and 2.7 times as long as deep; the caudal crests are not developed at all on its proximal fourth. Nostrils large, directed vertically upwards, and nearer a line connecting the anterior borders of the eyes than the tip of the snout; internarial space less than half the interocular; eyes superolateral; spiraculum a short, prominent, sinistral tube; anus

median. Mouth (fig. 6) very large, directed downwards, as wide as the body; upper lip fringed with very short, rather indistinct papillar lobules; lower lip finely denticulate; mandibles thick, but not strongly ceratinized. Two long rows of labial teeth extending over the full width of the mouth anteriorly, and four very much shorter ones posteriorly; a single, very small, knob-like papilla on the inner surface of both the upper and the lower lips on each side.

Brown above, obscurely mottled with darker; caudal crests with a brown stippling; white beneath, with a few brown dots on the pectoral region.

The example, which has almost completed its metamorphosis, measures 28 mm. from the tip of the snout to the hinder side of the thighs. It is brown, with obscure darker and lighter markings, and the folds on the forearm and tarsus are picked out in white.

REPTILIA.

SQUAMATA.

Geckonidæ.

Gecko vittatus Houtt.

8 ♂♂, ♀♀, Kokoda.

In life this species is pale green, the vertebral stripe being yellowish.

Gehyra vorax Girard.

2 ♂♂, Kokoda.

Gymnodactylus lousiadensis de Vis.

♀, Kokoda.

Gymnodactylus loriæ Boul.

2 ♂♂, Mondo.

Agamidæ.

Gonyocephalus dilophus (Dum. & Bibr.).

♂, Kokoda.

Gonyocephalus modestus Meyer.

♀, Mafulu.

Gonyocephalus papuensis (Macleay).

♂, 2 ♀♀, 2 juvs. Kokoda.

Varanidæ.*Varanus indicus* (Daudin).

8 juvs., Kokoda.

Scincidæ.*Tiliqua gigas* (Schneider).

1 juv., Kokoda.

Emoia cyanogaster (Lesson).

12 ♂♂, ♀♀, and juvs., Kokoda.

Emoia weneri (Vogt).

52 ♂♂, ♀♀, Kokoda.

2 ♀♀, Mondo.

1 ♂, Mafulu.

Despite many recent investigations into the status of this common form there still appears to be some dispute as to the correct name which should be applied to it. Schüz (1929, p. 8) restricted the name *weneri* to the form found in the Mariana Islands, and proposed the subspecies *weneri triviale* for the race found elsewhere. Burt and Burt (1932, p. 523), after comparison of material from the Marianas with specimens from the Papuan region (Solomons, New Hebrides, and Louisiade Archipelago), failed to find any reasons for retaining *triviale* as a distinct subspecies, and Hediger (1932, p. 10, and 1934, p. 515) also fails to recognize any subspecies, referring specimens from the Papuan region to *Emoia weneri*. But Schmidt (1932, p. 186), considering the status of the Marianas lizard to be doubtful, raises Schüz's southern subspecies to specific rank, a procedure in which he is followed, without comment, by Mertens (1934, pp. 39-90). In view of the direct comparisons made by the Burts there appears to be no adequate reason for this action, so the older name is used here.

Emoia baudinii (Dum. & Bibr.).

1 juv., Kokoda.

Leiolopisma fuscum (Dum. & Bibr.).

25 ♂♂, ♀♀, Kokoda.

Leiolopisma novæ-guinæ (Meyer).

Lygosoma curtum Boulenger, 1897, Ann. & Mag. Nat. Hist. (6) xix. p. 9.

6 ads., Kokoda.

Kopstein (1926, p. 89), after examining a very large series (133 specimens) of *L. novæ-guinæ*, has shown that in many characters, particularly the number of auricular lobules, there is considerable variation. The present series agrees well with the types of *curtum*, but differs from examples of *novæ-guinæ* only in the number of these lobules. Accordingly it seems probable that Boulenger's name must fall into synonymy.

Leiolopisma elegantoides (Ahl).

1 ad., Mondo.

Leiolopisma stanleyanum (Boul.).

Ad., Mondo, 5000 ft.

4 ads., Mt. Tafa, 8500 ft.

Leiolopisma miotis (Boulenger).

? *Lygosoma subnitens* Boettger, 1897, Abh. Mus. Dresden, vi. 7, 1896/97, p. 2.

2 ads., Kokoda.

Re-examination of the type of *L. miotis* reveals that the number of scales about the middle of the body is twenty-six instead of twenty-four, as originally stated. This disposes of the major difference between the descriptions of *L. miotis* and *L. subnitens*; the other differences in the proportions of the fronto-nasal and the length of the tail are such as may be expected to come within the limits of variation of a single species. But the examples from Moroka, British New Guinea, referred by Boulenger (1898, p. 706) to *subnitens* appear to represent a distinct allied species which lacks a name; they may be known as:—

Leiolopisma morokanum, sp. n.

Lygosoma subnitens (non Boettger) Boulenger, 1898, Ann. Mus. Geneva, (2) xviii. p. 700.

Holotype a ♀, number 97.12.10.52 in the British Museum, from Moroka; collected by Dr. L. Loria.

Distance between the end of the snout and the fore-limb contained 1.4 times in the distance between axilla

and groin. Snout moderately pointed. Lower eyelid with a transparent disc. Nostril in a divided nasal; no supranasal; fronto-nasal once and a third as broad as long, forming a straight suture with the rostral and touching the frontal at a point; frontal longer than its distance from the tip of the snout, a little shorter than the frontoparietal and interparietal together, and in contact with the first two supraoculars; four supraoculars and six or seven supraciliaries; frontoparietals fused; interparietal distinct; parietals forming a suture behind the latter; three pairs of enlarged nuchals. Four lower labials anterior to the subocular. Tympanum oval, as large as the palpebral disc and with three projecting lobules on its anterior border. Scales smooth, in twenty-eight series at the middle of the body, the two median dorsal series largest; a pair of enlarged pre-anals. Tip of fourth toe reaching the wrist when the limbs are adpressed; digits compressed distally, the fourth longest on each limb; twenty-three or twenty-four lamellæ beneath the fourth toe.

Bronze-green above, with a lighter mid-dorsal band, edged with brown, from the nape to the base of the tail; a narrow, light, dorso-lateral line, edged above by an incomplete brown line, from the supraciliary edge to the base of the tail; flanks below this line brown, with lighter coppery flecks and spots, becoming more numerous towards the belly, so that at their lower border the flanks are whitish, with brown flecks and blotches. Lower surface white, with a few indistinct brown dots on the chin and beneath the tail.

Dimensions :—

	Holotype. mm.	Paratype. mm.
Snout to ear	10	11
Snout to vent	43	47
Tail	59 (regenerated)	
Fore limb	13	14
Hind limb	18	20

The paratype, an example with an incomplete tail, was obtained at the same place as the type by Dr. Loria. It differs only in having the prefrontals forming a median suture, the fronto-nasal being consequently relatively broader in proportion to its length, and the presence of eight supraciliaries.

The species is allied to *miotis*, but differs in the larger number of scales around the body, the larger ear, with auricular lobules, the divided nasal, more numerous sub-digital lamellæ, and the colour-pattern.

Leiolopisma semoni (Oudemans).

1 juv., Kokoda.

It seems probable that this species may be subdivisible into two races, a northern form with twenty-six scale rows and a southern with twenty-eight. All the specimens in the British Museum from British New Guinea (seven) have twenty-eight scale-rows, but are otherwise indistinguishable from a typical example from Dutch New Guinea which has twenty-six.

Lygosoma flavipes, sp. n.

Holotype a ♀, number 1935.5.10.149 in the British Museum, from Mondo (5000 ft.), Papua; collected in March 1934 by Miss L. E. Cheesman.

This species is referable to the subgenus *Hinulia* of Boulenger or *Sphenomorphus* auct.; but Smith (1935, p. 279) is followed in using *Lygosoma* pending a complete revision of the whole difficult group. There are no palpebral discs and no supranasals.

Snout blunt. Distance between the tip of the snout and the fore-limb contained once and a third in the distance between axilla and groin. Rostral forming a straight suture with the frontonasal, which is once and a half as broad as long; prefrontals distinctly separated: frontal as long as the frontoparietals and interparietal together, and in contact with the two anterior supraoculars; four supraoculars, followed by one very small one; eight supraciliaries; frontoparietals distinct; parietals in contact and bordered by a large upper temporal and a nuchal. Nostril in a small single nasal; an anterior and a posterior loreal, the latter the longer; three superposed præoculars; four labials anterior to the subocular. Ear-opening small, round, not half the diameter of the eye-opening and without projecting lobules. Scales indistinctly grooved, in thirty-eight series at the middle of the body; mid-dorsals very much larger than the ventrals. Preanals enlarged. Limbs short, just meeting when adpressed. Digits distinctly dilated at the base

and compressed distally, the distal phalanges forming an angle with the basal ones (cf *L. anolis* and *L. virens*); eleven or twelve lamellæ beneath the basal, and eight beneath the distal part of the fourth toe.

Copper-colour above, each scale faintly dark margined; a brown, light-spotted band from the eye to above the ear; flanks light-speckled; lower surfaces white, heavily mottled with copper, especially on the body, regenerated portion of the tail with dark spots on each scale, forming regular lines. The soles of the feet and the expanded portions of the digits are bright chrome-yellow; distal phalanges brown.

	mm
Length from snout to ear	19.5
Snout to vent	87
Tail (regenerated)	100
Fore limb	22
Hind limb	28

The adhesive modification of the feet of this species would appear to indicate relationship with species such as *Leiopisma anolis* and *L. nitens*, but, as Smith has shown (1935, p. 276), a similar condition occurs in the genus *Dasia*. If these genera really represent natural assemblages it would appear that the same arboreal adaptation has arisen independently on several occasions.

Lygosoma jobiense Meyer.

11 ads., Kokoda.

Boidæ.

Enygrus carinatus (Schneid.).

5 ads., Kokoda.

Chondropython viridis (Schlegel).

1 juv., Kokoda; 1 juv., Mafulu.

Colubridæ.

Natrix mairii (Gray)

2 ♂♂, Kokoda. V. 153, 148, C. 82+1, 82+1.

Stegonotus modestus (Schlegel).

♀, Mafulu. V. 211; C. 81+1.

Juv. ♀, Kokoda. V. 202; C. 83+1.

Dendrelaphis punctulatus lineolatus (Jacq. & Guich.).

2 ♂♂, juv., Kokoda. V. 191, 194, 199; C. 114+n, 144+1.

The generic name applicable to these tree-snakes is still a matter of dispute (Meise & Hennig, 1932, 1935; Stejneger, 1933; Mertens, 1934 a), but, after a consideration of the various arguments put forward, the views of Mertens are here adopted. The later opinions of Meise and Hennig do not appear acceptable, for it is quite irrelevant in what sense Fitzinger was using the name in 1826, as he did not fix a type-species. This was done very distinctly by Boie in the following year, and, as there can be no question of *Dendrophis* Fitzinger and *Dendrophis* Boie being homonyms, this designation must stand.

Mertens is also followed in regarding *lineolatus* as a subspecies of *punctulata*, but Meise and Hennig's (1932) disposal of *D. meeki* (Boul.) as a synonym of *lineolatus* is open to doubt. The two are undoubtedly very closely allied, but there is a constant colour-difference, *meeki* having the upper lip yellowish and bordered above by a black line which extends on to the neck and demarcates the boundary between the dorsal and ventral colour. In addition the ventral scale count is lower than in examples of *lineolatus* from the same region, though the two overlap if the total range of variation in all localities is considered. The counts of the various subspecies of *punctulatus* are as follows:

D. p. striolatus (Peters).—V. 172–205; C. 119–135. (After Meise & Hennig.)

D. p. lineolatus (Jacq. & Guich.).—V. 172–209; C. 133–158 (36 specs.).

D. p. punctulatus (Gray).—V. 191–221; C. 118–144 (26 specs.).

But there is also some variation in the ventral count of the subspecies *lineolatus* in different parts of New Guinea. Thus, in nineteen specimens from the north-west of the island (Dutch New Guinea) the ventrals range from 172 to 199, whereas in seventeen examples from the south-east (British and Mandated New Guinea and the coastal islands) there are from 190 to 209. It is only in the latter region that *meeki* has been reported, and the eight specimens available show a ventral count of from 168 to 179

only, the caudals ranging from 139 to 147. There may also be a distinct penial difference, though sufficient material is not available to check the probable range of variation in this character. In both *punctulatus* and *meeki* the distal extremity of the hemipenis bears a non-inversible papilla, which is beset, like the rest of the organ, with horny spines. In *punctulatus* this terminal papilla is long, about $\frac{1}{4}$ to $\frac{1}{3}$ the length of the rest of the penis, but in *meeki* it is very short, less than $\frac{1}{7}$ the length of the whole penis.

Dendrelaphis meeki (Boul.).

2 ♂♂, Kokoda. V. 173, 177 ; C. 142+n, 141.

Boiga irregularis (Merrem).

♀, Mafulu. Sc. 23, V. 253, C. 83+n.

Aspidomorphus mülleri interruptus Brongersma.

♂, juv., Kokoda. V. 166, 163 ; C. 31+1, 36+1.

The male is a paratype (Brongersma, 1934, p. 232).

Aspidomorphus schlegeli (Günther).

2 juv. ♂♂, Kokoda. V. 148, 140 ; C. 24+1, 25+1 (Brongersma, 1934, p. 236).

Toxicocalamus stanleyanus Boul.

3 ♂♂, Mafulu. V. 238, 246, 240 ; C. 50+1, 46+1, 49+1.

Apistocalamus pratti Boul.

♂, Mafulu. V. 196 ; C. 40+1.

This, the second example of the species to be found, agrees admirably with the type except in the arrangement of the temporals, ventral colour, and size. On one side the temporals might be described as 1+2 instead of 1+1, the ventral shields, instead of having a median dark brown spot, have the whole anterior edge stippled with brown, and the total length is 460 mm., of which 73 belong to the tail.

TESTUDINES.

Emydura novæ-guinæ (Meyer).

1 shell, 2 juvs., Kokoda.

REFERENCES.

- BOULENGER. 1897. Ann. & Mag. Nat. Hist. (6) xix. p. 12.
 ——. 1898. Ann. Mus. Genova, (2) xviii. pp. 694–710.
 ——. 1914. Trans. Zool. Soc. London, xx. p. 249.
 ——. 1920. Rec. Ind. Mus. xx. pp. 1–226.
 BRONGERSMA. 1934. Zool. Mededeel. xvii. pp. 161–251, pls. i.–ii.
 BURT & BURT. 1932. Bull. Amer. Mus. Nat. Hist. lxiii. p. 5.
 HEDIGER. 1932. Verh. Nat. Ges. Basel, xlv. 2, pp. 1–25.
 ——. 1934. Zool. Jahrb. Syst. lxxv. 5/6, pp. 441–582.
 KOPSTEIN. 1926. Zool. Mededeel. ix. pp. 71–112.
 MEISE & HENNIG. 1932. Zool. Anz. xcix. pp. 273–297.
 ——. 1935. Zool. Anz. cix. pp. 138–150.
 MERTENS. 1934. 'Zoologica,' xxxii. vi. p. 84.
 ——. 1934 a. Arch. f. Naturg. N.F. iii. 2, pp. 187–204.
 NOBLE. 1931. Biol. Amphibia (New York).
 PARKER. 1934. 'Frogs of the Family Microhylidæ' (London).
 ROUX. 1910. Abh. Senck. Nat. Ges. xxxiii. p. 225.
 SCHMIDT. 1932. Pub. Field Mus. Nat. Hist. Zool. xviii. pp. 175–190,
 pl. viii.
 SCHÜZ. 1929. Abh. Mus. Dresden, xvii. 2, pp. 1–16.
 SMITH. 1935. Fauna Brit. India, Rept. & Amph. ii.
 STEJNEGER. 1916. Proc. Biol. Soc. Washington, xxix. p. 85.
 ——. 1933. 'Copeia,' pp. 199–203.
 VAN KAMPEN. 1906. Nova Guinea, v. 1, p. 164.
 ——. 1913. *Ibid.* ix. 3, p. 455, pl. xi. fig. 1.
 ——. 1914. Zool. Jahrb., Syst. xxxvi. 4, pp. 365–378.
 ——. 1923. Amph. Indo-Austr. Arch. (Leiden).
 — & BRONGERSMA. 1931. 'Treubia,' xiii. 1, p. 16.

VI.—Ueber die von Miss Cheesman auf den Neu-Hebriden gesammelten Brenthiden (Coleoptera). Von R. KLEINE, Stettin.

VON den Neu-Hebriden sind mir folgende Brenthiden bekannt: *Bulbogaster hebridarum* Fairm., *Ithystenius françoisi* Desbr., *I. hebridarum* Senna, *I. nigrosulcatus* Fairm. Davon ist nur *I. Françoisi* Fairm. wieder aufgefunden worden. Die Ausbeute umfasst 6 Arten, davon ist 1 neu, 4 sind bisher von den Neu-Hebriden noch nicht bekannt gewesen und 1, wie schon gesagt, von dort gemeldet.

CALODROMINI.

Callipareius flavolineatus Calabr.

Ausser der Type ist kein Belegstück bekannt geworden. Fundort: Neu-Caledonien. Die Art hat einen intermediären Habitus und man kann darüber streiten, ob die überhaupt zu den Calodromini gehört. Es ist aber

ausser Zweifel dass sie noch am besten dahin passt wohin sie Calabresi gestellt hat.

Malekula. 1 Exemplar.

BELOPHERINI.

Anomobrenthus hamatirostris Fairm.

Ausser den typischen Exemplaren, die sich im Hamburger Museum befinden, dürften bisher keine weiteren Belegstücke gefunden worden sein. Die Hamburger Stücke stammen von den Fiji-Inseln.

Santo-Isl., viii.-ix. 1929, 1 ♂♀.

ITHYSTENINI.

Ithystenus françoisi Desbr.

Ich kenne die Art von den Salomonen, dem Bismarck-Archipel und Neu-Guinea. Sie ist auch schon von den Neu-Hebriden bekannt und, wie es scheint, häufig. In der Ausbeute fand ich 5 ♂♂ und 7 ♀♀.

Santo-Isl., Malekula : Ounua.

Ithystenus sabulosus Kleine.

Die Art ist nicht gerade häufig aber sehr weit verbreitet, so : Queensland, Neu-Guinea, Aru-Isl., Ost-Molukken.

1 ♂♀ von Malekula und der Banks-Isl., Vanua Lava.

PSEUDOCEOCEPHALINI.

Eubactus semixeneus Lacord.

Von den Fiji-Inseln sah ich zahlreiche Belegstücke, von dort ist die Art auch beschrieben.

5 ♂, 5 ♀ von Santo-Isl.

Schizotrachelus quæsitus, sp. n.

Pechschwarz mit grünem Erzschimmer, am ganzen Körper hochglänzend. Kopf fast doppelt so lang wie breit, nach dem Hals und Rüssel verschmälert, Hinterrand in der Mitte dreieckig eingekerbt, keine Furche, Punktierung zart, einzeln, Unterseite mit durchgehender, kräftiger Mittelfurche, Punktierung fast ganz fehlend; Augen weit vorgerückt, flach. Metarostrum walzig, breit und tief gefurcht, Mesorostrum mit schmaler Furche,

Prorostrum walzig, Punktierung zerstreut aber kräftiger als auf dem Kopfe. 2.-6. Fühlerglied quadratisch, 7. und 8. mehr quer, scharfkantiger, 9. und 10. vergrößert, 9. etwas länger als breit, 10. quadratisch, 11. so lang wie das 9. und 10. zusammen, konisch. Prothorax schlank, eiförmig, gegen den Hals verschmalert, mit kräftiger, ganz durchgehender Mittelfurche und zarter, zerstreuter Punktierung. Auf den Elytren ist nur die 1. und 2. Rippe entwickelt, Furchenpunktierung flach, Basis ungezähnt, die 2. Rippe aber verdickt. Beine normal. Metasternum und das 2. Abdominalsegment schmal gefurcht.

Länge (total) : 11.5 mm. Breite (Prothorax) : 2 mm.

Aneityum, xi. 1930.

1 ♀. Typus in Britischen Museum.

Aus Polynesien habe ich schon mehrere *Schizotrachelus* bekannt gemacht, von den Neu-Hebriden ist es der erste Vertreter. Die Art ist schon durch die Ausfärbung als ein Vertreter der Südseeinseln gekennzeichnet und erinnert darin an andere Brenthiden des Gebietes. Charakteristisch ist die tiefe Furchung der Kopfunterseite, die an *Metatrachelus* erinnert. Da alle sonstigen Merkmale aber mit *Schizotrachelus* übereinstimmen und *Metatrachelus* auch rein orientalisch ist, dürfte die Stellung bei *Schizotrachelus* berechtigt sein. Der Kopfform nach gehört sie in die zweite Gruppe meiner Gattungstabelle (Kopf schmal, viel länger als breit, parallel, oblong).

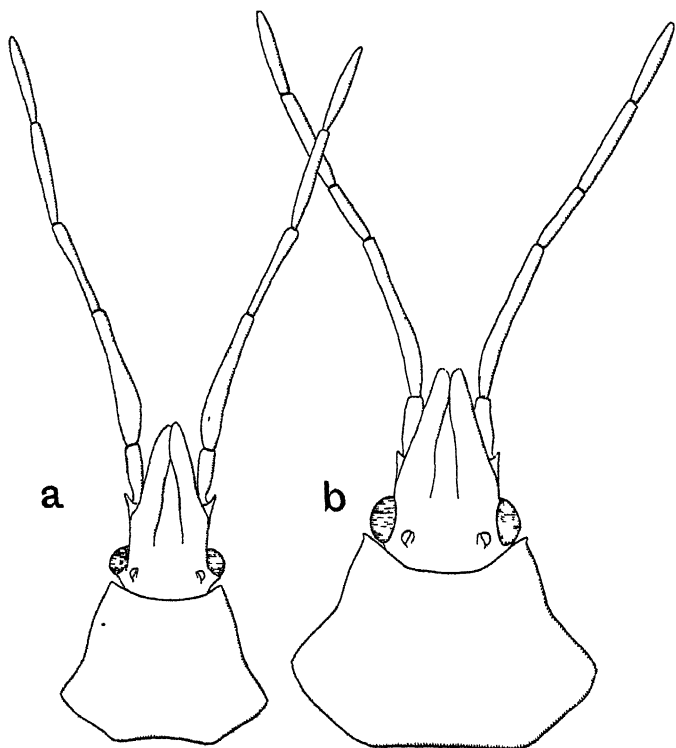
VII.—A new Species of *Mecidea* (*Heteroptera*, *Pentatomidæ*) from Arabia. By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History).

THE following description is based on material collected by Mr. W. H. Ingrams in the Hadhramaut. Several new species were represented among the Hemiptera collected, but unfortunately, in most cases, by unique specimens only. In these cases it is advisable to refrain from describing them until further material is available. The opportunity has been taken, however, to dedicate a new species of *Mecidea* to Mr. Ingrams in recognition of his work on the insect fauna of this region.

Family Pentatomidæ.

Mecidea ingramsi, sp. n. (Fig. a.)

Colour.—Pale straw-yellow, the fourth and fifth antennal segments, apices of tibiæ, and the tarsi more or less fulvous, eyes black. Two narrow fuscous lines down dorsal surface of abdomen not extending on to penultimate segment.



Diagrammatic representation of head and pronotum.
Both $\times 12$.

a. *Mecidea ingramsi*, sp. n., ♀, Arabia.

b. *Mecidea pallida* Stål, ♀, Biskra, Algeria.

Punctuation of head, pronotum, and scutellum slightly fulvous, more so immediately behind pronotal calli and down each side of pronotum behind middle of eye; a narrow slightly elevated lævigatè line down middle of pronotum and scutellum and costal margins of hemielytra,

whitish. Rather scale-like hairs on basal three joints of antennæ fuscous.

Structure.—Head narrow, elongate, only two-thirds as wide across eyes as long in middle (28 : 42), jugæ contiguous in front of tylus, extending well in front of it. First antennal segment not nearly reaching apex of head, second segment strongly dilated towards base; relative length of segments 11 : 32 : 23 : 25 : 21. Antenniferous tubercles prominent, acute. Pronotum distinctly longer than broad at anterior margin (31 : 27); the anterior angles relatively obtuse, without teeth, the posterior angles relatively acute compared with *M. pallida*.

Total length 11 mm.; width across humeral angles 2.3 mm.

ARABIA : Hadhramaut, 1 ♀ (type), Gaur el Murekabah, 7. xi. 1934, 1 ♀, Wadi Maseila, 10. xii. 1934 (W. H. Ingrams).

Closely allied to *M. pallida* Stål (see fig. b), but a smaller and narrower species with relatively longer head compared with width across eyes, the second antennal segment more strongly dilated at base, the third segment nearly as long as fourth (in *pallida* it is distinctly shorter than fourth), and the pronotum longer than broad at anterior margin. Resembles *M. indica* Dall. in relative length of antennal segments, but differs from that species in narrower and more elongate form.

The specimen from Wadi Maseila is much smaller than the type.

VIII.—*Weitere Beiträge zur Kenntnis der parasitären Raupenfliegen* (Tachinidæ=Larvævoridæ) von den Salomonen und Neubritannien. Von N. BARANOV (Entomologe des Institutes für Hygiene in Zagreb, Jugoslavien).

NACH der Veröffentlichung meiner beiden kleinen Arbeiten über die Raupenfliegen von den Inseln des pazifischen Ozeans* erhielt ich vom Imperial Institute of Entomology in London noch weitere Tachinidensendungen zum Bestimmen. Da sich unter diesem Material sehr

* 'Stylops,' iii. 1934, pp. 181–184, und 'Veterinarski Arhiv (Zagreb),' iv. 1934, pp. 472–484.

interessante und prächtige, bisher unbekannte Formen befinden, halte ich es für zweckmässig, diese schon jetzt zu veröffentlichen, ohne auf die Möglichkeit zu warten, die Tachinidenfauna der pazifischen Inseln in grösserem Masstabe bearbeiten zu können. Die Typen der neuen salomonischen und neubritannischen Arten befinden sich im British Museum in London.

Die dieser Arbeit beigelegten Bestimmungstabellen haben den Zweck, die morphologischen Beziehungen der melanesischen *Eutachina*- und *Erycia*-ähnlichen Arten zu den mehr bekannten orientalischen Arten darzutun, was ja für zoogeographische Betrachtungen unentbehrlich ist. Für jene Gattungen und Arten, welche bis jetzt noch nicht publiziert sind, in der Bestimmungstabelle jedoch angeführt werden, gebe ich die betreffenden Diagnosen.

I. SALOMON-INSELN.

1. *Cuphocera varia sumatrensis* Towns. 1 ♂, British Solomons, 2. v. 1934, leg. R. J. A. W. Lever; 1 ♀, Guadalcanal, Ruavatu, 2. v. 1934, leg. R. J. A. W. Lever.

Das Abdomen des Männchens ganz ohne rötliche Farbe (nur die Genitalien rötlich), beim Weibchen nur die Hinterleibsspitze etwas rötlich. Ich halte diese Form für *sumatrensis* Towns., die Exemplare mit mehr oder weniger rötlichem Abdomen dagegen für *varia* Fabr. vera (=forma *malayana*, mihi in litteris und *formosana*, mihi in litteris). Nach dem Studium sehr zahlreicher orientalischen Exemplare aus verschiedenen Lokalitäten konnte ich feststellen, dass die europäischen und orientalischen Exemplare konstante Besonderheiten aufweisen, auf Grund deren sie als zwei selbständige vikariierende Arten aufzufassen sind. Die europäischen Exemplare müssen nun den Namen *argyrocephala* Macq. tragen, während die orientalischen als *varia* Fabr. zu belassen sind. Erstere Art lässt sich so charakterisieren: Kopf mit silberweissem Reif; Flügel durchsichtig; Postokularcilienreihe geht auf die Backen über; zweites Genitalsegment des ♂ ohne längere Borsten. Die Art *varia* dagegen: Kopf mit gelblichem oder sogar goldiggelbem Reif; Flügel deutlich getrübt; Postokularcilienreihe nicht bis auf die Backen reichend; zweites Genitalsegment des ♂

mit einigen längeren und stärker entwickelten Borsten zwischen der gewöhnlichen Beborstung.

2. *Sturmia sericariae* Corn. 1 ♀, Mala, Su'u, 24. v. 1934, leg. R. A. Lever.

Weit verbreitete Art.

3. *Sturmia inconspicuoides* Baran. 1 ♀, Tulagi, 23. iii. 1934, leg. R. J. A. W. Lever.

Weit verbreitete Art.

4. *Catacarcelia kockiana* Towns. 1 ♂, Bougainville Is., Kieta, v. 1934, leg. J. L. Froggatt.

Bekannt von Sumatra und Java.

5. *Phorocerosoma anomala*, sp. n. 1 ♂, Ugi Is., 6. v. 1934, leg. R. A. Lever.

Typus dieser Art (*Exorista anomala*, mihi in litteris) ist von Formosa (im Deutsch. Entom. Institut in Berlin-Dahlem). Die Beschreibung dieser Art ist noch nicht veröffentlicht und lautet wie folgt:

Grösser als *Ph. forte* Towns., mit stärkeren Borsten, bleifarbigem Kopf, ungleichlang beborsteten Hinter-schienen, Diskalmakrochäten auf dem Abdomen und viel kürzeren Paraloben des Hypopygiums. Beim Weibchen die letzten Abdominalsternite breit sichtbar, die Stirn mit einer nach aussen gerichteten Prävertikalborste. Körperlänge 12–13 mm.

Diese ist Art eine primitive Form, welche die Merkmale von *Exorista* und *Helicobosca* gleichzeitig in sich vereinigt. Die andere Art dieser Gattung—*Phorocerosoma forte* Towns.—ist von Sumatra und Formosa bekannt und ist weniger primitiv als *anomala*.

6. *Bactromyia fransseni* Baran. 1 ♀, Tulagi, 23. iii. 1934, leg. R. A. Lever.

In der orientalischen Region weit verbreitet.

7. *Erycia nigricosta*, sp. n. 1 ♂, Guadalcanal, Kankau, 22. viii. 1934, leg. L. A. Lever.

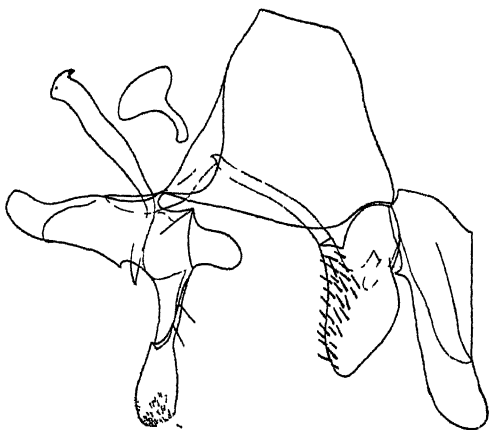
Stirnbreite am Scheitel beträgt $\frac{1}{2}$ der Augenbreite. Ocellarborsten vorhanden. Kopfbereifung gelblich. 2. Fühlerglied und die Taster rot. Backenhöhe beträgt $\frac{1}{5}$ der Augenhöhe. 3. Fühlerglied $2\frac{1}{2}$ mal so lang wie das zweite. Thorax dicht, goldig bereift. Sterno-

pleuralborsten 2+1. Abdomen ohne Diskalmakrochäten. 2. Tergit ohne, 3. mit 2 mittleren Randborsten. Schüppchen gelblich. Flügel am Vorderrand dunkel. Abdomen an den Seiten breit rötlich. Beine schwarz. Hinterschienen aussen vorn bewimpert, ohne Zwischenborste. Schildchen mit 1 Lateralborste. Klauen und Pulvillen lang. Körperlänge 9 mm.

8. *Eutachina aurichalcea*, sp. n. 1 ♀, Bougainville Is., Kieta, v. 1934, leg. J. L. Froggatt.

Eine prächtige Fliege von tief schwarzer Grundfarbe, mit dichtem messinggelbem Toment, etwas an *Chryso-*

Fig. 1.



Hypopygium von *Erycia nigricosta*, sp. n.

sarcophaga superba Towns. erinnernd. Kopf messinggelb bereift. Hinterkopfbehaarung gelblich. Stirnstrieme, Fühler und Taster tief schwarz. Plastische Merkmale wie bei *larvarum* L., nur die Frontalborsten nicht so weit auf die Wangen herabsteigend. Längsstriemen des Thorax paarweise zusammenfliessend und so zwei breite Längsstreifen bildend. Pleuren fleckenartig, graugelblich bereift. Schildchen mit dichtem, messinggelbem Toment, nur an den Seiten mit schwarzem Streif, welcher im basalen Teil mit langen Haaren bedeckt ist. Abdomen ventral

und das ganze 2. Segment schwarz. Die nachfolgenden Segmente mit schmalen schwarzen Apikalbinden. Abdomenspitze beiderseits buschelartig beborstet. 2. und 3. Tergit mit 2 starken mittleren Randborsten. 4. Tergit mit einer Makrochatenreihe am Rande. 5. Tergit mit apikaler und subapikaler Makrochatenreihe. Flügel geschwarzt; 3. Längsadern an der Basis mit 4 Borstchen. Beine schwarz; Vorderschenkel hinten gelblichgrau bereift; Vorderschienen vorn nur in den basalen $\frac{2}{5}$ beborstet, hinten mit 2 Borsten; Hinterschienen aussen vorn ungleich beborstet; Klauen schwarz, Pulvillen braun. Körperlänge $13\frac{1}{2}$ mm.

Ohne Kenntnis des Männchens ist es nicht möglich die nächsten Verwandten dieser Art festzustellen, was von besonderem Interesse wäre, nachdem diese prächtige Fliege ohne Zweifel eine für die Salomonen spezifische Modifikation ist. Die Stammform dieser Eutachine dürfte eine der weit verbreiteten orientalischen Arten sein.

9. *Chaetexorista solomonensis*, sp. n. 1 ♂, Shortland, Korovo, 23. iv. 1934, leg. H. T. Pagden.

Sehr ähnlich *Ch. javana* B. B. unterscheidet sich aber deutlich von dieser durch die goldgelb bereiften Orbiten, die dichtere Körperbereifung und durch die geringe Anzahl (nur 2) der auf die Wangen herabsteigenden Frontalborsten. Hinterschienen aussen vorn ohne jede aus gleichlangen Borsten bestehende Borstenreihe, im Gegensatz zu *javana*, bei welcher in den meisten Fällen eine Wimperreihe ganz deutlich ausgeprägt ist. Forceps dorsal in basaler Hälfte mit schwarzer Behaarung (bei *javana* hell). Körperlänge 13 mm.

10. *Gymnomedoria medinoides* Towns. 4 ♂♂, Malaita, Su'u, 15. viii. 1934, leg. H. T. Pagden.

Bekannt von Formosa.

11. *Formosia mirabilis solomonicola*, ssp. n. Typus: ♂, Guadalcanal, Kankau, 21. viii. 1934, leg. R. A. Lever. Typus: ♀, Guadalcanal, Kieta, v. 1934, leg. J. L. Froggatt. Paratypische Exemplare: ♀, Renodova, 14. v. 1934, leg. H. T. Pagden; ♀, Montgomery, Tetipari, 12. v. 1934, leg. H. T. Pagden; ♂ und ♀, New Georgia, Segi, Morovo Lagoon,

5. v. 1934, leg. H. T. Pagden. Weitere Exemplare :
 ♀, Tulagi, Ridge, 31. iii. 1934, leg. H. T. Pagden ;
 ♂, Calwel, i. 1932 ; ♀, Isabbel.

Sehr ähnlich *F. mirabilis* Guér., jedoch mit kürzeren Fühlern und heller Behaarung der Meso- und Sternopleuren. Flügel weniger gebräunt, mehr rotlich. Thorax hellgrün, ins Rötliche spielend (nicht ins Bläuliche). Körperlänge 16–18 mm., Flügelänge 15–17 mm.

12. *Lioproctia antilope* Boettch. 1 ♂, Ulawa, 19. v. 1934, leg. R. A. Lever.

Beide Genitalsegmente sind schwarz. Orientalisch. In der australischen Region ist diese Gattung durch einige Arten vertreten, welche obiger Art sehr ähnlich sind.

13. *Chrysosarcophaga magnifica*, sp. n. Typus : ♂, Kolombangara, Tack Harbour, Karikana Est., 8. vi. 1934, leg. H. T. Pagden, in jungle. Paratypus : ♂, 9. vi. 1934, dieselbe Lokalität.

Von *Ch. superba* Towns. unterscheidet sie sich durch das glänzend schwarze Abdomen, welches nur auf dem 5. Tergit ganz fein silbrigweiss bereift ist. Bei gewisser Betrachtung kann man auch an den Seiten der übrigen Tergite Spuren von solchem Toment entdecken. Stirn mit 2 reklinaten Frontalborsten. Akrostichalborsten vor der Naht : 1 Paar dicht vor der Naht, die übrigen, kaum differenzierten im vorderen Teil des Mesothorax. Schildchen bald mit starken, bald mit feinen Lateralborsten ; Diskalborsten fein oder ganz fehlend. Hinterrandsmitte des 3. Abdominaltergites mit 2 Borsten. Alle Tibien mit Pelzbehaarung ; Mittelschenkel mit Ctenidium. 1. Genitalsegment schwarzbraun, stumpf, ohne Borstenquerreihe ; 2. Genitalsegment glänzend schwarz. Flügelmembran getrübt, Adern braun gesäumt. Genitalien wie bei *superba* Towns. Hinterrand des 4. Abdominalsternites mit Haarbüschel (Sturmiafleck). Körperlänge 20 mm., Flügelänge 14½ mm.

Diese Fliege kann nicht in den Enderlein'schen Gattungen untergebracht werden, ist aber ohne Zweifel mit *Chrysosarcophaga superba* Towns. engstens verwandt und diese beiden bilden zusammen mit *Lioproctia antilope* Boettch. einen Verwandtschaftskreis.

14. *Thyrsocnema albiceps* Meig. 2 ♀♀, Guadalcanal, Lunga, 18. iii. 1934, leg. R. A. Lever. 1 ♀, Guadalcanal, 18. iii. 1934, leg. R. J. A. W. Lever.

Weit verbreitet.

Kopf und Thorax intensiv goldgelb. Schildchenrand zwischen Basal- und Angularborste mit noch einigen stärkeren Borsten ausser der gewöhnlichen Behaarung. Hintere präsuturale Akrostichalborsten deutlich entwickelt. Abdomen mit etwas bläulichem Glanz. Flügeladern braun gesäumt, besonders an der Basis. Körperlänge 12 mm.

15. *Cylindrothecum necopinatum* Rohd. 2 ♂♂ und 3 ♀♀, Gizo Is., 30. ix. und 1. x. 1933, leg. H. T. Pagden, ex *Megachile*.

Diese salomonischen Exemplare unterscheiden sich von den paläarktischen wie folgt: die Anzahl der Frontalborsten und der Borsten am Mundrande ist geringer, die helle feine Behaarung der Backen fehlt fast ganz; Basalbinden der Abdominaltergite nur schmal unterbrochen; Beugung der Medialader spitzwinkelig. Sonst kaum von meinen Exemplaren aus Krapina, Jugoslawien verschieden. Körperlänge 8 mm.

Bisher nur aus Europa und Ostsibirien bekannt. Ausser von den Salomonen kenne ich diese Art auch von Formosa (Sammlung Tokano).

16. *Paratricyclea aurescens*, sp. n. ♂, Guadalcanal, Rere, 12. viii. 1934, leg. R. A. Lever.

Schwarze Fliege, Kopf und Körper goldgelb bereift. Abdomen mit schwarzen Apikalbinden. Flügel in der basalen Hälfte bräunlichgelb, an der Flügelwurzel noch intensiver gefärbt. Schüppchen bräunlichgelb.—Stirn am Scheitel doppelt so breit wie das 3. Fühlerglied. Frontalborsten fein. Wangen nur im oberen Teil beborstet. Fühler rötlich, das 3. Glied dunkel. Taster dunkelbraun, dem Ende zu rötlich. Facialcarina im oberen Teil bis zum Niveau der Fühlerborste breit, etwas vertieft, der untere Teil schmal. 3. Fühlerglied 3 mal so lang wie das zweite. Backenhöhe beträgt $\frac{1}{2}$ der Augenhöhe. Thorax mit 4 undeutlichen Längsstriemen. Akrostichalborsten 1+2; Dorsozentralborsten 2+3; Intraalarborsten 1+2; Sternopleuralborsten 2+1. Schildchen jederseits mit 3 Borsten. 3. Abdominaltergit mit 2 mittleren Rand-

makrochäten, 4. Tergit mit einem Borstenkranz, 5. mit Randmakrochäten und einigen lateralen Diskalborsten. Flügel mit deutlichem Randdorn; 3. Längsader nur an der Basis beborstet. Klauen und Pulvillen mässig lang. Körperlänge 8 mm.

Diese Fliege ist wahrscheinlich der Vertreter einer neuen Gattung, jedoch ist es besser, diese Frage erst nach dem Studium einer grösseren Anzahl Exemplare endgültig zu lösen.

II. NEUBRITANNIEN.

1. *Cuphocera varia sumatrensis* Towns. 1 ♀, Rabaul, 29. ix. 1934, leg. J. L. Froggatt.

Aus unbekannter Larve gezüchtet.

2. *Sturmia bella* Meig. 2 ♂♂, Rabaul, 28. viii. 1934, leg. J. L. Froggatt, ex "Lep. larva on rice."

3. *Sturmia inconspicuoides* Baran. 1 ♂, Rabaul, 11. ix. 1934, leg. J. L. Froggatt, ex "larva of *Crocidolomia binotalis* Zell."

4. *Zenillia roseanella*, sp. n. 1 ♂, Rabaul, 29. i. 1934, leg. J. L. Froggatt, ex "Lepidopterous larva."

Die Beschreibung dieser Art bezieht sich auf Exemplare von Formosa und ist bis jetzt noch nicht veröffentlicht worden. Führe sie hier an dieser Stelle an:

Sehr ähnlich *roseanæ* B. B., unterscheidet sie sich von dieser wie folgt: Kleiner, länglicher, mit etwas bräunlichen Flügeln; Vertikalborsten fehlen; Ozellarborsten kräftiger; nur 3 herabsteigende Frontalborsten; Reklinate viel kräftiger als die übrigen Frontalen; Schildchen mit 2 Lateralborsten und halbaufgerichteten gekreuzten Apikalborsten; 3. Hinterleibsring ohne Diskalborsten, 4. mit 1 Paar, welche nicht deutlich sind; Klauen und Pulvillen lang; Penis ohne Basalzahn.

5. *Stomatomyia tricholygoides* Bezzi, 1 ♀, 6. ii. 1934, leg. J. L. Froggatt, ex "Lepidopterous larva in maize stalks."

Von den Fidschi-Inseln und Neukaledonien bekannt.

6. *Thyrsocnema albiceps* Meig. 2 ♀♀, Rabaul, Keravat, 10. vii. 1934, leg. J. L. Froggatt.

Weit verbreitet. Mit den Besonderheiten der salomonischen Exemplare.

7. *Lioproctia crinita* Park. 1 ♂, 4 ♀♀, Rabaul, 2 ii 1934, leg J. L. Froggatt, ex larva "in abdomen of dead beetle" 2 ♀♀, Rabaul, 13 ii. 1934.

Orientalisch und australisch.

Kopf- und Thorakalbereifung gelblich 4 Sternopleuralborsten Hinterschenkel vorne unten mit nicht unterbrochener Borstenreihe. 3. Tergit ohne mittlere Randborsten. Körperlänge 9 mm.

Bestimmungstabelle der Eutachina-ähnlichen Arten.

- | | | |
|---------|---|--|
| 1 (26) | Augen dicht behaart | |
| 2 (9). | Facialien mit aufsteigenden Borsten
(bis über die Mitte) (<i>Phorocera</i>
R D) | |
| 3 (8) | Ohne Diskalborsten | |
| 4 (5) | Borsten auf den Facialien fein, dicht
und mehr oder weniger unregelmäßig
angeordnet | [sp n
<i>Phorocera imperator</i> , |
| 5 (4) | Borsten auf den Facialien stark, nicht
zahlreich, gewöhnlich die oberen
noch stärker als die unteren | |
| 6 (7) | Kleinere Form, ♂ nicht länger als
14½ mm | <i>P magna</i> Baran |
| 7 (6). | Grossere Form, ♂ mindestens 16 mm
(Unterscheidet sich von der Nominatform durch etwas breiteren Forceps und Paraloben, durch den ungeknieten Basalzahn des Penis, die unregelmäßig angeordneten Tastborsten der hinteren Haken und durch die Apikalborste der vorderen Haken, welche deutlich stärker als die anderen Borsten ist Originalfundort Formosa) | <i>P magna f maxima</i> , n |
| 8 (3). | Mit Diskalborsten . . . | <i>P pumilio</i> Ald |
| 9 (2) | Facialien ohne aufsteigenden Borsten.
(<i>Tricholyga</i> Rond + <i>Chaetoxorista</i> B
B) | |
| 10 (13) | Hinterschienen dicht bewimpert, ohne
Zwischenborste | |
| 11 (12) | Beugung der 4 Langsader stumpfwinkelig | <i>eutachinoides</i> Baran
[(= <i>Blepharipoda eutachinoides</i> Baran, 1932)
<i>Chaetoxorista javana</i>
[B B |
| 12 (11) | Beugung rechtwinkelig | |
| 13 (10) | Hinterschienen niemals bewimpert,
nur zuweilen mit mehr oder weniger
regelmässiger Borstenreihe, jedoch
immer diese Borsten von verschiedener Länge | |
| 14 (15) | Mittlere Abdominalsegmente mit Diskalborsten | <i>basalis</i> Baran |
| 15 (14) | Mittlere Abdominalsegmente ohne
Diskalborsten | |
| 16 (17) | Thorax mit 3 mittleren Langstriemen | <i>psychidarum</i> Baran |

- 17 (16). Thorax mit 2 mittleren Längstriemen.
- 18 (21). Frontalborsten weit herabsteigend.
- 19 (20). 3. Fuhlerglied fast dreimal so lang wie das zweite *sorbillans* Wied.
- 20 (19). 3. Fuhlerglied doppelt so lang wie das zweite *aberrans* Strobl.
- 21 (18). Frontalborsten nur wenig herabsteigend.
- 22 (25). 3. Längsader weit hinauf beborstet.
- 23 (24). Kopfweißlich. Hinterkopfborsten hinter den Cilien mit schwarzen Borstchen, unten weiß behaart. Facialien mit einigen aufsteigenden Borsten [B. B.]
Chatezorista javana
- 24 (23). Kopf gelblich. Hinterkopf ohne schwarze Borstchen hinter den Cilien, unten gelblich behaart. Facialien nur dicht oberhalb der Vibrissen mit Borsten *C. solomonensis*, sp. n.
ladelli, sp. n.
- 25 (22). 3. Längsader nur basal beborstet
- 26 (1). Augen nackt. (*Eutachina* B. B.)
- 27 (28). Backen ohne schwarze Behaarung und Beborstung, nur mit weißlichen Haaren *civiloides* Baran.
- 28 (27). Backen mit schwarzer Behaarung und gewöhnlicher Beborstung.
- 29 (30). Stirnstrieme viel schmäler als die Orbiten [= ? *japonica* Towns.]
tenuiforceps Baran.
- 30 (29). Stirnstrieme ungefähr ebenso breit oder breiter als die Orbiten.
- 31 (32). 3. Abdominaltergit mit 4 mittleren Randborsten *quadriseta* Baran.
- 32 (31). 3. Abdominaltergit mit 2 mittleren Randborsten.
- 33 (40). 3. Längsader mit 3 Borstchen an der Basis. Stark beborstete Arten mit mehr borstigem Haarkleid des Abdomens, zuweilen mit echten Diskalborsten.
- 34 (37). Flügeladern ohne deutlichen braunen Saum.
- 35 (36). Stirn und oberer Teil der Wangen blassgelblich bereift, Abdomen sehr oft mit Diskalborsten *hyalipennis* Baran.
- 36 (35). Stirn und oberer Teil der Wangen ausgesprochen goldig bereift, Abdomen nie mit Diskalborsten *aureifrons*, sp. n.
- 37 (34). Flügeladern mit deutlichem braunen Saum.
- 38 (39). Stirn und oberer Teil der Wangen blassgelb bereift *fuscipennis* Baran.
- 39 (38). Stirn und oberer Teil der Wangen ausgesprochen goldig bereift [sp. n.]
aureifrons sumatrana,
- 40 (33). 3. Längsader mit mindestens 4 Borstchen an der Basis. Weniger stark beborstete Arten mit mehr feinem Haarkleid des Abdomens, niemals mit Diskalborsten auf den mittleren Segmenten.

- 41 (44). Abdomen mit scharf ausgeprägten Basalbinden.
 42 (43). Weissliche Basalbinden der Abdominalsegmente viel schmaler als die glänzend schwarzen Apikalbinden.. *rusticella*, sp. n.
 43 (42). Weissliche oder gelbliche Basalbinden breiter als die Apikalbinden *larvarum* L.
 44 (41). Ohne Basalbinden. Thorax dicht goldgelb bestäubt *aurichalcea*, sp. n.

DIE NEUEN ARTEN.

1. *Eutachina aureifrons*, sp. n. ♂, Java, Sumatra.
 (Typus im Zoologischen Museum in Buitenzorg.)

Sehr ähnlich *hyalipennis* und *fuscipennis*. Unterscheidet sich von beiden durch die ausgesprochen goldig bereifte Stirn, die goldgelbe Behaarung oben am Hinterkopf, die gelbliche, stark entwickelte Behaarung, welche fast die ganze Dorsalseite des Forceps bedeckt und durch das anders geformte Hypopygium.—Stirnbreite am Scheitel beträgt $\frac{2}{3}$ der Augenbreite. Stirnstrieme ungefähr so breit wie die Orbiten. Wangen viel breiter als die Fühler, welche schmal sind. Fühlerborste fein und lang, im basalen Viertel verdickt, mit verlängertem 2. Glied. Vibrissen deutlich oberhalb des Mundrandes stehend. Facialien mit Borsten, welche nicht bis zur Mitte aufsteigen. Ocellarborsten stark. 2 reklinierte Frontalborsten; 5 bis zum Niveau der Fühlerborste herabsteigende Frontalborsten. Taster lang und dünn, schwarz, nur an der äussersten Spitze rötlich. Orbiten und der obere Teil der Wangen goldgelb. Thorax und Schildchen schwarz, gelblichgrau bestäubt. 4 schwarze Längsstriemen. 4 postsuturale Dorsozentralborsten; 3 Sternopleuralborsten. Abdomen länglich, mit breiten, grauen Basalbinden. Auf dem 3. Tergit deutliche schwarze Längsmittellinie, welche auf dem 4. nur undeutlich ist und auf dem 5. ganz fehlt. Diskalborsten auf den mittleren Segmenten fehlend. 2. und 3. Tergit mit je einem Paar mittlerer Randborsten. 3. Längsader mit 3 Borsten an der Basis. Beugung mit Faltenzinke. Randdorn fehlt. Beine schwarz, mit sehr langen Klauen. Körperlänge 12 mm., Flügellänge 10 mm. Diese Art ist mir in zwei Unterarten bekannt:

1. Flügel hyalin. Körperbereifung mehr grau-gelb. Java *aureifrons aureifrons*.
 2. Flügeladern mit breitem, braunem Saum. [ssp. n.
 Körperbereifung mehr goldgelb. Sumatra. *aureifrons sumatrana*,

2. *Eutachina rusticella*, sp. n. ♂. Typus: Formosa, Takao, 28. xi. 1907 (Stettiner Museum). Sumatra (Imperial Institute of Entomology).

Am nächsten zu *rustica* Fall., sich aber durch das unverlängerte Endstück des Penis deutlich unterscheidend.

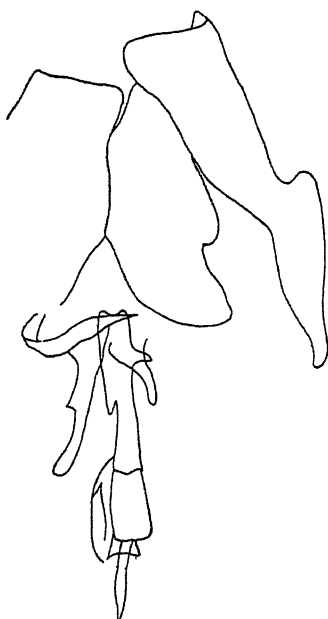
Stirnbreite am Scheitel beträgt $\frac{2}{3}$ der Augenbreite. Aussere Vertikalborsten fehlend. Reklinate Frontalborsten, von welchen 2 vorhanden sind, sowie Ozellarborsten, ebenso lang wie die nach hinten gebogenen Vertikalborsten. Dunkelbraune Stirnstrieme ebenso breit wie die gelblich schimmernden Orbiten. 4 gekreuzte und 4 herabsteigende Frontalborsten, die letzteren bedeutend stärker als die ersteren. Wangen unten kaum breiter als das 3. Fühlerglied. Fühler lang, 3. Glied doppelt so lang als das zweite. Fühlerborste lang, in beiden basalen Fünfteln verdickt, mit ein wenig verlängertem 2. Glied. Backenhöhe beträgt $\frac{1}{2}$ der Augenhöhe. Augen nackt (nur mikroskopisch fein behaart). Facialien nur mit einigen Borsten oberhalb der Vibrissen. Backen mit schwarzen Börstchen. Taster rot. Thorax schwarz, mit grauem, nicht dichtem Toment und gewöhnlicher Striemung. 4 Dorsozentralborsten hinter der Naht. 3 Sternopleuralborsten. Schildchen schwarz, mit gekreuzten, aufgerichteten Apikalborsten. Abdomen schwarz, mit weissen Basalbinden, welche den Seiten zu stärker ausgeprägt und breiter sind. 2. und 3. Tergit mit je einem Paar mittlerer Randborsten. Diskalborsten auf den mittleren Segmenten fehlend. Flügel glashell. 3. Längsader an der Basis mit 6 Börstchen. Beine schwarz, mit langen Klauen und Pulvillen. Hinterschienen aussen vorn mit zahlreichen ungleichlangen Borsten. Körperlänge 7 mm.

3. *Eutachina ladelli*, sp. n. ♂, Siam, Hua Hin, iv. 1926, leg. W. R. S. Ladell. Typus im British Museum.

Am nächsten zu *Chaetexorista javana* B. B., jedoch mit ganz anders gebauten Genitalien.—Kopf intensiv goldgelb. Herabsteigende Frontalborsten nur bis zum Ende des 2. Fühlergliedes. Vibrissen soviel oberhalb des Mundrandes stehend als das 3. Fühlerglied breit ist. Taster dunkelbraun, am Ende rötlich. Bereifung des Körpers gelblich. Vorderrand der Flügel bräunlich. 3. Längsader mit 4 dicht stehenden Börstchen an der Basis.

Hinterschienen aussen vorn dicht aber ungleich beborstet.
Körperlänge 15 mm.

Fig. 2.



Hypopygium von *Eutachina ladell*, sp. n.

4. *Phorocera imperator*, sp. n. ♂, Samanga, S.-Celebes, xi. 1895, leg. H. Fruhstorfer. Typus in der Sammlung von Colb. J. Wainwright (Handsworth, Birmingham, England).

Steht *Phorocera magna*, mihi am nächsten unterscheidet sich aber von dieser durch Folgendes: Körperform schlanker. 3. Fühlerglied ca. $2\frac{1}{2}$ mal so lang wie das zweite. Facialien mit zahlreicheren, mehrreihigen, jedoch feineren Borsten. Taster schwarz. Ocellarborsten stark. 2. Tergit mit 2 starken mittleren Randborsten. Forceps im Profil gerade, schmal und lang; der dorsale Teil der Basis ohne dichte Behaarung. Körperlänge 19 mm.

Bestimmungstabelle der Erycia-ähnlichen-Arten.

Als *Erycia*-ähnliche Arten fasse ich jene Tachininen auf, welche sich um die Arten *festinans* Meig. und *basifulva* Bezzi gruppieren.

- 1 (2). Längliche Fliege. ♂ mit scharf begrenztem Sturmfleck; ♀ mit abgeplatteten Vordertarsen *Platerycia compressa*, [sp. n.]
- 2 (1). Gedrungene Fliege. ♂ ohne Sturmfleck. Vordertarsen des ♀ normal.
- 3 (4). Das ♀ (♂ unbekannt) mit verlängertem 5. Abdominalsegment, welches reichlich so lang ist wie das 3. und 4. Segment zusammen *Erycia bezzii* Baran.
- 4 (3). Das ♀ nicht mit solch stark verlängertem 5. Abdominalsegment.
- 5 (6). Ozellarborsten fehlend. Flügelbasis und Schüppchen gelblich. 2. Fühlerglied rötlich. 2 Sternopleuralborsten *E. basifulva* Bezzi.
- 6 (5). Ozellarborsten vorhanden.
- 7 (10). Abdomen vorherrschend rötlich.
- 8 (9). Schenkel rötlich. 3. Längsader mit 2 Börstchen an der Basis. (Nur ♀ bekannt.) *E. rufofemorata*, sp. n.
- 9 (8). Beine ganz schwarz. 3. Längsader mit 6 Börstchen an der Basis. (Nur ♂ bekannt.) *E. nigricosta*, sp. n.
- 10 (7). Abdomen und Beine ohne rote Farbe.
- 11 (12). 2 reklinate Frontalborsten. Stirn des ♀ so breit wie ein Auge. Fast das ganze Abdomen weisslichgrau bereift, mit nur wenig deutlichen schwarzen Apikalbinden *E. nymphalidophaga*, [sp. n.]
- 12 (11). 1 reklinate Frontalborste. Stirn des ♀ deutlich schmaler als ein Auge. Abdomen mit schmalen silberweissen Basalbinden *E. palpata*, sp. n.

DIE NEUEN GATTUNGEN UND ARTEN.

PLATERYCIA, gen. nov.

(Gatt.—Type: *P. compressa*, sp. n.)

Von *Erycia* R. D. (Gatt.—Type: *E. festinans* Meig.) durch folgende Merkmale verschieden: Körperform schlank. Stirnprofil lang, daher die Fühler unterhalb der Augenmitte inseriert. Klauen des Männchens kurz. Vordertarsen des Weibchens etwas abgeplattet. Beim Männchen das Schildchen mit einer, zuweilen mit mehreren Lateralborsten, beim Weibchen nur mit einer. Abdomen etwas kompress. Männchen mit stark entwickelten Sturmflecken auf dem 4. Abdominaltergit. Vorderrand der Flügel vor der Spitze stark geschweift. Beugungsstelle der Medialader rechtwinkelig bis spitzwinkelig. Spitzenquerader stark konkav. Hinterschienen aussen vorn mit einer Borstenreihe, welche aus ungefähr gleichlangen Borsten besteht.

Platerycia compressa, sp. n. (= *Erycia compressa*, mihi in litteris). 3 ♂♂, 2 ♀♀. Formosa, leg. H. Sauter. Im Deutsch. Entomol. Institut in Berlin-Dahlem.

♂. Stirnbreite beträgt am Scheitel $\frac{2}{3}$ der Augenbreite. Innere Vertikalborste nach hinten gebogen, äussere fehlt. Ozellarborsten haarfein. Stirnstrieme bedeutend schmaler als die Orbiten. 4 starke reklinierte Frontalborsten. 3–4 Frontalborsten bis zum Ende des 2. Fühlergliedes herabsteigend. Orbiten nur mit wenigen Härchen. Frontalprofil wenig gewölbt, etwas länger als das Facialprofil. Stirn wenig vorspringend. Wangen breiter als das 3. Fühlerglied, nach unten zu kaum verschmälert. Fühler ziemlich schmal, schwarz, 3. Glied $2\frac{1}{2}$ mal so lang wie das zweite. Fühlerborste nur an der Basis verdickt. Vibrissen in der Höhe des Mundrandes stehend. Facialien im unteren Drittel beborstet. Backenhöhe beträgt $\frac{1}{4}$ der Augenhöhe. Rüssel kurz. Taster dunkelbraun, schmal. Hinterkopf unten grau behaart. Orbiten, Wangen, Gesicht und Backen bleifarbig. Schildchen und Mesonotum glänzend schwarz, spärlich weiss bereift, letzteres mit 4 wenig deutlichen Längsstriemen; 3 Dorsozentralborsten hinter der Naht; Präsuturale Intraalarborste vorhanden; 4 Sternopleuralborsten; übrige Beborstung vollständig. Schildchen mit 1 Lateralborste und gekreuzten Apikalborsten; bei einem Männchen sind jederseits fünf Seitenborsten ausser den Apikalen vorhanden. Abdomen länglich, etwas komprimiert, glänzend schwarz, mit verlängertem 4. Segment und weissen Basalbinden. 2. Tergit ohne mittleren Randborsten, 3. mit einer, 4. mit Borstenkranz, 5. in apikaler Hälfte beborstet. Diskalborsten fehlend, nur bei einem Männchen das 4. Tergit mit 1 Diskalborste. 4. Tergit an den Seiten mit grossem, stark ausgeprägtem Sturmfleck. Flügel etwas gebräunt, mit deutlichem Randdorn. 3. Längsader fast bis zur kleinen Querader beborstet. 4. Längsader mit rechtwinkliger oder spitzwinkliger Beugung, mit oder ohne Aderanhang. Spitzenquerader stark nach aussen gebogen. Erste Hinterrandzelle schmal offen. Beine schwarz; Klauen und Pulvillen kurz; Beborstung ziemlich fein; Mittelschienen mit Innenborste und aussen vorn mit 1 Borste; Hinterschienen aussen vorn mit regelmässiger Borstenreihe und Zwischenborste. Körperlänge 7–8 mm.

♀. Wie das Männchen, jedoch mit 2 Orbitalborsten, helleren Tastern, nur 2 herabsteigenden Frontalborsten, ohne Sturmiafleck, mit weniger regelmässiger Borstenreihe der Hinterschienen, etwas kräftigeren Beinen und mit stärker gebräunten Flügeln, besonders längs der Adern; Körperlänge 7–8 mm.

Erycia rufofemorata, sp. n. ♀, Buitenzorg, ii. 1933, leg. R. W. Paine. Typus im British Museum.

Eine Tachine von normalen morphologischen Beschaffenheiten, deren koloristische Merkmale sie jedoch gut charakterisieren.—Augen nackt. Stirn am Scheitel breiter als die halbe Augenbreite. Ocellarborsten vorhanden, nach vorne gerichtet; 2 Orbitalborsten. Fühler schmal, 2. Glied rot, etwas verlängert, 3. beiläufig 3-mal so lang wie das zweite. Fühlerborste fein und lang. Wangen schmal, Backenhöhe beträgt $\frac{1}{4}$ der Augenhöhe. Taster rot, stark entwickelt. Thorax und Schildchen grau bestäubt, mit vollständiger Beborstung. 3 Sternopleuralborsten. Abdomen länglich, rötlich, mit schwarzen Dreiecken auf dem Dorsum der Tergite 2–4, mit deutlichen Basalbinden und roter Spitze. Flügel getrübt; 1. Hinterrandzelle an der Flügelspitze mündend, offen; Beugung der Medialader nicht weit vom Flügelrande; 3. Längsader mit 2 Börstchen an der Basis. Beine kräftig; Hüften rot, Schenkel rot mit schwarzen Spitzen, Schienen schwarzbraun, Tarsen schwarz; Hinterschienen ungleich beborstet. Körperlänge 7 mm.

Erycia nymphalidophaga, sp. n. Typus ♂: Dehra Dun, U.P., 5. x. 1929, leg. N. C. Chatterjee. Aus Nymphalidæ auf *Citrus aurantium*. Typus ♀: Exemplar derselben Serie mit Datum 6. x. 1929. Paratypische Exemplare (2 ♂♂, 4 ♂♂) mit Daten 5–11. x. 1929.

♂, ♀. Augen nackt. Facialien unbeborstet. 1. Hinterrandzelle vor der Flügelspitze schmal offen. Vibrissen am Mundrande. 4 postsuturale Dorsozentralborsten, 3 Sternopleuralborsten. Schildchen mit gekreuzten Apikalen und 3 Seitenborsten. Abdomen ohne Diskalborsten. Hinterschienen aussen vorn mit regelmässiger, aus gleichlangen Borsten bestehenden Borstenreihe und einer längeren Borste in der Mitte.

♂. Stirnbreite beträgt am Scheitel $\frac{3}{4}$ der Augenbreite. Stirnstrieme breiter als die Orbiten. Mit ausseren Vertikalborsten. 2 reklinate Frontalborsten. Orbiten mit schwarzen Borstchen. Die Frontalborsten steigen auf die Wangen bis zum Niveau der Fühlerborste herab. 3. Fühlerglied 4 mal so lang wie das zweite, welches rotlich ist. Backen so hoch wie die Breite des 3. Fühlergliedes. Wangen um die Hälfte schmaler. Taster rot, deutlich verbreitert. Bereifung des Kopfes silberweiss. Thorax und Abdomen gelblichgrau bereift; Thorax mit 4 schwarzen Langsstriemen, Abdomen mit ebensolcher Längsmittellinie und schmalen schwarzen Apikalbinden. Flügel hyalin, Schuppchen milchigweiss. 3. Längsader mit 2 Borstchen an der Basis. Beine schwarz, Klauen und Pulvillen lang.

♀. Stirn am Scheitel so breit wie ein Auge. Sonst mit den gewöhnlichen Geschlechtsunterschieden. Körperlänge $6\frac{1}{2}$ mm.

Erycia palpata, sp. n. 1 ♀, Formosa, 1 schlecht erhaltenes Exemplar in meiner Sammlung.

♀. Schwarze längliche Fliege, mit etwas gebräunten Flügeln, glanzend schwarzem Abdomen und schmalen silberweissen Basalbinden. Stirnbreite am Scheitel beträgt $\frac{2}{3}$ der Augenbreite. Die stark entwickelten Ocellarborsten stehen etwas hinter dem vorderen Punktauge. Nur 1 reklinate Frontalborste; 4 herabsteigende Frontalborsten. 3. Fühlerglied ziemlich breit, nur um ein Geringes länger als die doppelte Länge des zweiten. Wangen schmal; Backenhohe beträgt $\frac{1}{10}$ der Augenhöhe. Taster hellrot, dem Ende zu stark verbreitert. Hinterkopf ohne schwarze Borsten. Thorax spärlich, weisslichgrau bestäubt, mit undeutlicher Striemung und vollständiger Beborstung. Sternopleuralborsten 2+1. Schildchen mit 1 Lateralborste und gekreuzten Apikalen; am Rande etwas rotlich durchscheinend. Hinterleib langlich; 2. und 3. Tergit mit 1 Randborste. Diskalborsten fehlend. Beugung der Medialader stumpfwinkelig; 3. Längsader mit 3 (2) Borstchen an der Basis. Beine schwarz; Mittelschienen aussen vorn mit einer mittelstarken Borste; Hinterschienen aussen vorn mit einer Reihe gleichlanger Borsten und Zwischenborste. Körperlänge $6\frac{1}{2}$ mm.

IX.—*The African Species of Teleasinae (Hym., Proctotrupoidea, Fam. Scelionidae)*. By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History).

THE bulk of the material forming the subject of the present paper was obtained by Mr. R. E. Turner in South Africa.

The types of all species brought forward as new are contained in the collections of the British Museum, except where otherwise stated.

The material available for study has certainly been scanty, and in several cases new species have been erected on single specimens. This will involve the exercise of a certain degree of caution in interpreting descriptions. The members of the Teleasinae evidently show a considerable amount of sculptural variation, so that the description of a single individual is not likely, by a long way, to encompass the whole range of variation possible within the species to which it belongs. Nevertheless, by including these single individuals, I have been able to form, by necessarily closer analysis, a more accurate opinion of the characters used for the separation of the species, and, in consequence, my treatment of the subfamily approximates probably to a more worthwhile study than might otherwise have been achieved.

The Teleasinae form among the Proctotrupoidea, in so far as my experience permits me to express an opinion, a very compact group, the fully winged members of which are easily recognizable by the venation. This latter is characteristic by reason of the long marginal vein, which is apparently never, or but rarely a little, less than three times the length of the stigmal vein; the stigmal vein is itself very short, thereby heightening a contrast in comparative lengths, which in the closely allied subfamily Scelioninae is either never present or, if it occurs at all, is the product of a comparison between a very short marginal and a relatively long stigmal vein. The correct placing of species with rudimentary wings is less easy by means of absolute characters. The most reliable criteria are to be found in a combination of the shape of the abdomen, in which the third tergite

is by far the longest *, and that of the clypeus; this is prominent and has acute lateral angles.

A few words are necessary concerning certain details of structure of which some use has been made. The sculpture of the mesopleura sometimes provides useful characters for the separation of groups of species. The mesopleurum is always provided with a longitudinal depression for the reception of the intermediate femora, which is situated roughly parallel to the posterior margin of the sclerite. This depression may or may not be delimited in front by a ridge, the presence or absence of which is evidently constant within a species. The convex surface beneath, and more or less anterior to, the depression may be either smooth or, more generally, rugose.

It will be seen from my table for males of *Hoplogryon* that I have divided them into two groups according to the position of the antennal insertion and the structure of the hair-like sensillæ of the funicle. The distinction works out in practice for the African species, but I would hesitate to assert that it would be tenable if a universal application of it were attempted. The minor classification of the Proctotrupoidea is still in a chaotic condition. It will be only when the vast and bewildering conglomeration of species, arbitrarily conceived and superficially described, has been conscientiously worked through, after comparison with the types, that the happy state will be reached when it will be possible not only to formulate new ideas of classification, but also to realize the possibility of giving them practical effect.

The outline figures have been prepared by myself, with much labour. As a warning to students who may be rashly tempted to deduce anatomical principles from them, I would point out that they are diagrammatic and serve no other purpose than to assist in the identification of species.

Subfamily *TELEASINÆ*.

Key to the Genera.

1. Parapsidal furrows narrow, sharply defined, and complete throughout. (Species with the mesonotum in greater part markedly

* The exception which Kieffer makes here with *Gryon* Haliday is based on an error; the genotype of *Gryon*, *G. misellum* Haliday, is a true Scelionine belonging to the genus *Hadronotus*.

- smooth and shining or both sexes with vestigial wings.) [(Africa). *Trimorus* Först.
- Parapsidal furrows wanting or at most present posteriorly and then extending hardly beyond the middle of the mesonotum, or their imaginary course represented by two or three fine raised lines .. 2.
2. Scutellum unarmed; small to moderate-sized insects, at most 2.4 mm. long. *Hoplogryon* Ashm. (including *Allogryon* Kieffer and *Teleas* Latr.).
- Scutellum armed with a large tooth at each antero-lateral corner; very large insects never less than 4.8 mm. *Macrogryon*, gen. nov.

TRIMORUS Först.

1. Fore wings vestigial in both sexes, extending hardly beyond apex of tergite 1. (Small black sp., 1 mm. approx., with the antennæ of somewhat exaggerated form in ♀, the club being very strongly thickened and funicle 1 and 2 hardly longer than wide; tergite 3 not at all transverse.) *iphias*, sp. n.
- Wings fully developed 2.
2. Front, declivous part of the mesonotum crowded with large, coarse, more or less confluent punctures; tergite 3 without regular basal striations *nephele*, sp. n.
- Front, declivous part of the mesonotum at most finely rugulose; tergite 3 with very short, very well-defined striations along its entire basal margin, the segment otherwise smooth. *atys*, sp. n.

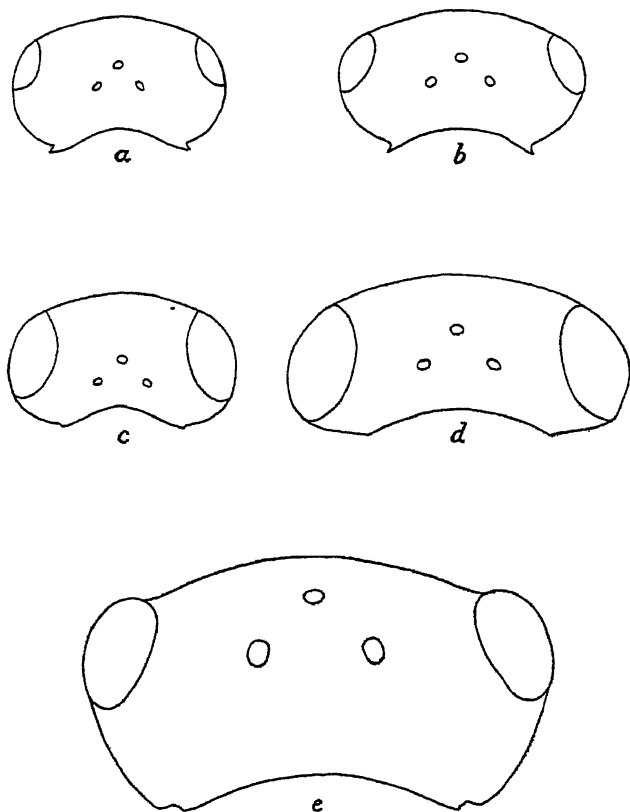
Trimorus iphias, sp. n.

♀.—Brownish black. Antennæ and legs brownish yellow. Tergite 1 and base of 2 markedly reddish.

Head less transverse than usual and, seen along a line perpendicular to a line between the posterior ocelli, a little less than twice as wide as its greatest length, 17:9 (fig. 1 a). Eyes clothed sparsely with very short, inconspicuous hairs, very small, by no means occupying the entire lateral surface of the head when this is seen from above; malar space about as long as the eye. Frons almost everywhere entirely smooth and shining. Towards the anterior ocellus, *i. e.*, on the brow, there are scattered, minute, ill-defined punctures. A fine ridge, obliterated to some extent medially, extends from the anterior ocellus to the antennal insertions. Posterior (declivous) part of the vertex more or less smooth and shining. Antennæ short (fig. 6 a); scape, when the head is seen from the side, not reaching to the level of the

vertex; funicle 1 and 2 more or less spherical; 3 and 4 very small, not much more than half the width of 1; 5 very strongly transverse, saucer-shaped; club very thick and short, about $2\frac{1}{2}$ times as long as wide. Anterior ocellus situated at the posterior edge of a small pit.

Fig. 1.



Head of: *a*, *Trimorus iphias*, sp. n., ♀; *b*, *T. nephele*, sp. n., ♀; *c*, *Hoplogryon amphiaraus*, sp. n., ♀; *d*, *H. schœneus*, sp. n., ♀; *e*, *Macrogyron phuto*, sp. n., ♂.

Thorax markedly narrower than the head and somewhat flattened above. Mesonotum about twice as wide as long (this measurement excludes the tegulæ), very shining, and predominately smooth. Complete parapsidal furrows present; these tend to be slightly widened

posteriorly. Scutellum strongly transverse. Postscutellar process more or less wanting, represented only by a very small, inconspicuous tooth. Propodeal teeth prominent, but small.

Posterior face of the propodeum completely obscured by the 1st abdominal tergite. Mesopleural depression deep, without pits or punctures, completely unsculptured, the ridge bordering it anteriorly sharply defined; metapleura smooth and shining. Fore wings vestigial, extending hardly beyond the apex of tergite 1.

Abdomen less than twice as long as wide, about 19 : 11, strongly and more or less evenly convex, conspicuously wider than the thorax; tergite 1 fully $2\frac{1}{2}$ times as wide apically as long medially, somewhat swollen transversely, its striations more or less obliterated over its greater medial surface, so that it appears almost smooth and unsculptured; 2 with the usual striations; 3 very large, almost exactly as long as wide and in this respect characteristic; this tergite is without a trace of striation, is very shining, and is sparsely covered with very small, ill-defined punctures, from each of which a tiny hair arises; the surface everywhere between the punctures is very polished.

Length 1 mm. approx.

♂.—Much more typical of the genus than the ♀, from which it differs as follows:—

Antennæ about as long as the body; the funicular segments relatively short, with exception of the last, all about $1\frac{1}{2}$ times as long as wide; the vestiture consists of rough curled hairs, which are not longer than the segments are wide. Frontal ridge sharper than in the ♀.

Abdomen: Tergite 1 not obviously swollen transversely, and striated all over, though the striæ tend to be weaker in the middle of the segment; 3 a little wider than long, 6 : 5, very distinctly striated over its basal half; these striæ are very irregular, beyond them the segment has sparse minute punctures as in the ♀.

Length .8–1 mm.

CAPE PROVINCE (Port St. John), Jan., Feb., 4 ♂♂, 2 ♀♀.

This little species, in which both sexes possess vestigial wings, is very distinctive in the ♀ on account of the form of the antennæ and of the abdomen. The ♂ is much less characteristic, but is easily separated from the

males of other species described in this paper by the presence of parapsidal furrows and rudimentary wings. The fact that the ♂ has striations on the third abdominal tergite and the ♀ is without them might give rise to a doubt that they both belong to the same species. There is, however, such a close agreement in other, far more constant, characters that I do not feel in the least uncertain that the sexes are correctly associated. It is more than probable that if enough females were available for study some would show striations on the third tergite.

Trimorus iphias has very little in common with the following two species, with which I have been obliged to place it because of its complete parapsidal furrows. At this stage, I am not able to say that the species has any good characters which would warrant the erection of a new genus.

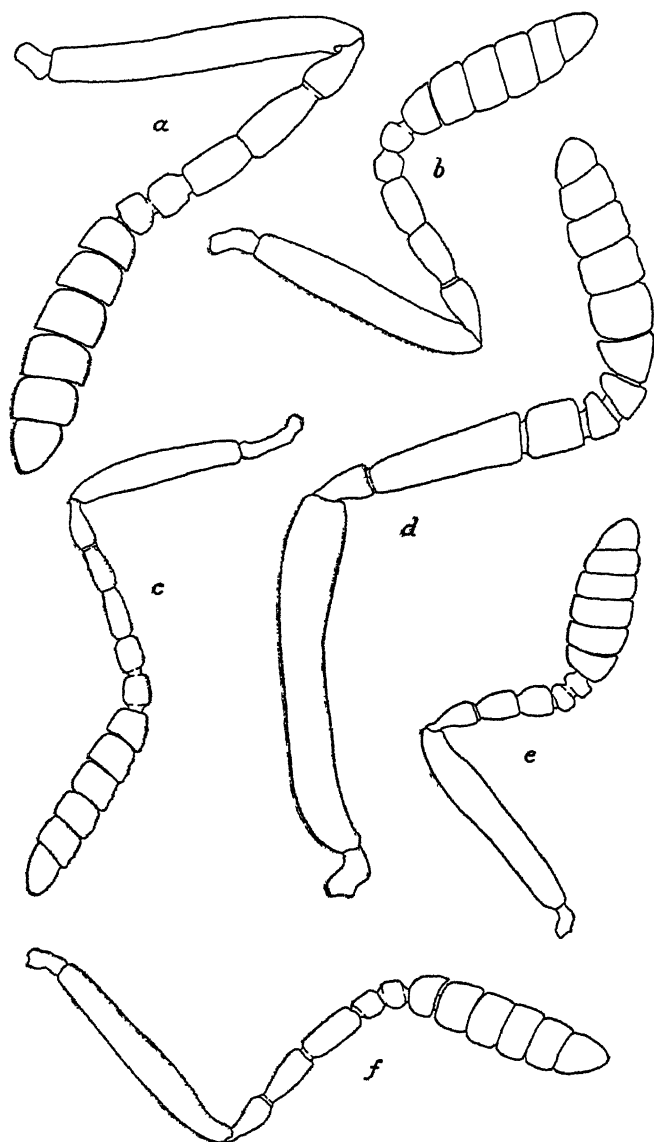
Trimorus nephela, sp. n.

♀.—Black. Legs brown or brownish yellow. Tergite 1 sometimes obscurely reddish. This is a very smooth, shining species.

Head less narrowed behind the eyes than is usual, hence appearing less transverse; seen from above, along a line perpendicular to a line between the posterior ocelli, less than twice as wide as long, about 15:8 (fig. 1 b). Occipital ridge prominent. Frons in far greater part, and the vertex everywhere very smooth and shining. Eyes small, clothed sparsely with short, but quite distinct hairs. Posterior ocelli separated from the eye-margin by a distance nearly $1\frac{1}{2}$ times as great as that between them. Antennæ long (fig. 2 a); scape, when the head is seen from the side, extending by fully a quarter of its own length above the vertex; funicle 1 about twice as long as wide; 2 a little shorter; 3 as long as wide; club of ordinary form. Apical width of the clypeus about as great as the distance between its mid-apical point and the base of the antennal prominence.

Thorax: Mesonotum right in front, i. e., within the angle formed by the posterior margin of the pronotum, smooth and shining; this smooth space is subtriangular and evidently corresponds to the specialized area seen in certain Scelionine genera (see Nixon, "A further Contribution to the Study of S. African Scelionidæ," Ann. & Mag. Nat. Hist. vol. xii. p. 289); behind this

Fig. 2.



Female antennæ of : *a*, *Trimorus nephele*, sp. n. ; *b*, *Hoplogryon magnes*, sp. n. ; *c*, *H. amphiarcaus*, sp. n. ; *d*, *Macrogyron cælebs*, sp. n. ; *e*, *Hoplogryon schæneus*, sp. n. ; *f*, *Trimorus atys*, sp. n.

area the brow of the mesonotum is crowded with large, coarse, more or less confluent punctures; the area occupied by this distinctive sculpture is transverse and extends right across the mesonotum; mesonotum otherwise, and in far greater part, entirely smooth and shining. Sharply defined, narrow parapsidal furrows present; these are very nearly parallel. Scutellum entirely smooth. Postscutellar spine somewhat short, but narrow, about half as long as the scutellum. Lateral areas of the propodeum without hairs and with some irregular, longitudinal rugæ. Mesopleural ridge well defined, the surface beneath it rather coarsely rugose-punctate.

Abdomen strongly narrowed basally; tergite 1 with its apical width not much greater than its medial length; 2 with well-marked radiating striations which reach the apex of the tergite; 3 rather strongly convex, at first sight quite smooth, but on close examination showing very superficial striations which are sometimes indicated to as far as the apex of the segment; these feeble striations do not appear to be stronger at the base of the tergite than elsewhere; 5 and 6 smooth, unsculptured.

Length 1.3–1.7 mm.

CAPE PROVINCE (Port St. John), April, May, July, 4 ♀♀.

This insect is very distinct on account of its smooth shining facies and the characteristic sculpture of the anterior part of the mesonotum. The sculpture of the mesonotum and of tergite 3 will readily separate it from the following species.

Trimorus atys, sp. n.

This species may be compared with *Hoplogryon amphiaras*, sp. n., as follows:—

♀.—Scape of the antennæ brownish yellow; pedicel a little paler than the four following segments, but in colour not contrasting sharply with them.

Head: Eyes a little less large and clothed with minute hairs, but not thickly. Antennæ (fig. 2 f) thicker, more powerful; radicle very short and inconspicuous, many times shorter than the scape; funicle 4 small, bead-like, hardly thicker than 1, so that the club is clearly differentiated; 2 distinctly longer than 1 as in *H. amphiaras*.

Thorax: Mesonotum very shining; in one ♀ (Port St. John) it is in greater part virtually unsculptured, with only a few granular rugulosity in front; in the other ♀ (Katberg) there are indications of very sparse, minute granulations all over, but in front the surface becomes finely rugose. Parapsidal furrows present, narrow, but very distinct and sharply defined. Scutellum, as in *H. amphiarus*, entirely smooth and shining. Post-scutellar spine very short and sharp. Lateral areas of the propodeum with sparse fine hairs, which in no way obscure their more or less smooth surface. Mesopleural ridge sharply defined, the surface in contact with it above—only the lower half of the ridge is considered—quite smooth, but margined below with a row of sharply defined pits; surface otherwise, below the ridge, smooth and shining.

Abdomen as in *Hoplogryon amphiarus*.

♂.—Legs more or less honey-yellow. Scape of the antennæ brownish yellow. Abdomen not so dark, so that there is a less sharp contrast between the reddish colour of tergites 1 and 2 and the following segments. Antennæ about $1\frac{1}{4}$ times as long as the body; funicle 2 a little shorter than the scape; entire funicle clothed with semi-erect fine hairs, which are about as long as the segments are wide.

Thorax: Mesonotum more or less smooth and polished all over.

Length 1.3 mm. approx.

CAPE PROVINCE (Port St. John), April, 1 ♀; E. CAPE PROVINCE (Katberg, 4000 ft.), Oct., 1 ♀, Dec., 1 ♂.

I associate the male with the above described females on account of similar sculpture, presence of parapsidal furrows, and, especially, on account of a similar lack of punctures margining the mesopleural ridge above. The parapsidal furrows and the short striations of tergite 3 will readily separate this male from that of any other species described in this paper.

It is noteworthy that the female of this species shares with the female of *Hoplogryon amphiarus* the peculiarity of having the second segment of the funicle longer than the first.

This species seems to have a close affinity with *Hoplogryon amphiarus* and *H. paris*, sp. n., and its

inclusion in a separate genus is perhaps unnecessarily artificial. When I have had the opportunity of studying the Teleasinae more extensively, I shall be able better to decide whether the retention of *Hoplogryon* as well as *Trimorus* is of practical value.

HOPLOGRYON (sensu lato) Ashm.



- | | | |
|----|--|----|
| 1 | Wings undeveloped, not reaching beyond the middle of tergite 2 | 2. |
| | Wings fully developed (Species with tergite 3 closely and strongly sculptured all over, the sculpture being predominately reticulate punctate or perhaps punctate) | 4 |
| 2 | Funicle 1 and 2 pale yellow, clothed with adpressed silvery hairs, tergite 3 apparently without striations, even at its extreme base | 1 |
| | Funicle 1 and 2 not pale yellow (being black or at least blackish) and not clothed with silvery hairs, tergite 3 clearly, but not always conspicuously, striated at its extreme base | 1 |
| 3 | Entire body, except the eyes and part of the antennae, bright brownish yellow or honey yellow | 3 |
| | At least the head entirely, and the abdomen in far greater part, black | 2 |
| 4 | Tergite 3 entirely unsculptured, smooth and shining | 2 |
| | Tergite 3 striated or otherwise sculptured, at least in places | 3 |
| 5 | Funicle 1 and 2 conspicuously clothed with adpressed silvery hairs, fore wings markedly smoky, hyaline at the base, and with a transverse hyaline band in the neighbourhood of the stigmalis | 3 |
| | Funicle 1 and 2 clothed only with the usual brownish adpressed hairs, fore wings unicolorous, even if smoky | 5 |
| 6. | Head and thorax above clothed conspicuously with adpressed, bright golden hairs (A very distinct species on account of the pubescence) | 9. |
| | Head and thorax above clothed only with extremely minute, reddish brown hairs, appearing almost glabrous (Species with funicle 1 and 2 pale brownish yellow and contrasting with the following black segments) | 6. |
| 7 | Clypeus considerably wider at apex (almost twice as wide) than the distance between its mid apical point and the base of the antennal prominence (Species with the mesonotum shining between its | 7 |
| | | 4 |
| | | 5 |

- punctures and rugulosities, conspicuously striated on its posterior third.) 22. *cyclops*, sp. n.
- Clypeus hardly wider at its apex than the distance between its mid-apical point and the base of the antennal prominence. 8.
8. Mesopleural ridge margined on both sides by a row of sharply defined, costæ-like punctures; scutellum virtually smooth all over; striations of tergite 2 radiating in the usual way, the middle ones reaching the apex of the tergite, the lateral ones not much shorter than the middle ones 7. *œcleus*, sp. n.
- Mesopleural ridge not margined on both sides by costæ-like punctures, at least the surface beneath (anterior to) the ridge being rugose-punctate; scutellum strongly sculptured all over in large examples; in small examples, 1.2 mm. approx., it tends to be smooth posteriorly; striations of tergite 2 very strong, not nearly reaching the apex of the segment, parallel, the lateral ones much shorter than the middle ones, so that altogether the striations occupy a more or less semicircular area 6. *magnes*, sp. n.
9. Tergite 3 extremely vaguely and superficially reticulated all over. (Small species, 1.1 mm. approx., with the frons entirely smooth and shining, and the mesonotum feebly shining and very finely and indefinitely sculptured; the scutellum is often entirely polished.) 21. *larius*, sp. n.
- Tergite 3 striated at least in part, or with a strong punctate element in its sculpture 10.
10. Tergite 3 with very short (none longer than tergite 1), very well defined striations along its entire basal margin, the segment otherwise quite smooth. (Small species 1.2 mm. approx., with the postscutellar spine very short, the abdomen strongly narrowed basally, tergite 1 and base of 2 conspicuously reddish or yellowish.) 11.
- Tergite 3 otherwise sculptured 12.
11. Radicle of the antennæ hardly less than one-third the length of the scape; mesonotum virtually smooth all over 19. *amphiaras*, sp. n.
- Radicle of the antennæ much less than one-third the length of the scape; mesonotum finely rugulose more or less all over 20. *paris*, sp. n.
12. Tergite 3 with a predominately punctate element in its sculpture, which sculpture is strong and covers virtually the whole segment. (Species with the frons in greater part strongly shining and with minute, not close, vague punctures; postscutellar spine long and strong.) 8. *scepsis*, sp. n.

- Tergite 3 without a conspicuous punctate element, predominately striated 13.
- 13 Clypeus much wider at apex (nearly three times as wide) than the distance between its mid apical point and the base of the antennal prominence (Species with the middle of the mesonotum irregularly—and in small examples somewhat delicately—reticulated on a more or less even surface, hind femora much swollen) [sp n.
- 24 (*Teleas*?) *incertus*,
- Clypeus hardly twice as wide at its apex as the distance between its mid apical point and the antennal prominence Hind femora not at all swollen 14
- 14 Funicle 2 hardly longer than wide (Species with the frons above somewhat shining and with clear indications of minute punctures) 9 *schæneus*, sp n
- Funicle 2 marked longer than wide 15
15. Frons above quite dull, with a more or less even sculpture, consisting of minute raised rugulosity 10 *codrus*, sp n.
- Frons above predominately shining and smooth, with only very superficial and feeble indications of longitudinal rugulosity 11 *pylus*, sp n.



1. Apical width of the clypeus clearly greater than the distance between its mid apical point and the base of the antennal prominence (fig 14) (Species with the antennæ thick, not, or hardly, longer than the body, the funicular segments not more than three times as long as wide; the hairs of the funicle are quite inconspicuous and much shorter than the segments are wide, under a high magnification ($\times 220$) these hairs are seen to consist of sensillæ of two sharply differentiated types —(1) short, thick, curved, and more or less blunt structures, and (2) very fine, pale, hair like setæ, which alone make up the more obvious clothing of the funicle when this is seen under a low magnification ($\times 30$) (fig 12 d))

2

Apical width of the clypeus by no means clearly greater—usually shorter—than the distance between its mid apical point and the base of the antennal prominence (fig 14) (Species with the antennæ slender, considerably longer than the body, the funicular segments usually considerably more than three times as long as wide, the hairs of the funicle are sufficiently upstanding and

- long to be conspicuous and on the whole are not less than half the width of the segments—usually much longer; under a high magnification ($\times 220$) these hairs can hardly be said to consist of two clearly differentiated types of sensillæ; if two types are obvious, the thicker ones are setiform and taper sharply to a point (fig. 12 b.) 4.
2. Middle of mesonotum irregularly (and in small examples somewhat delicately) reticulated on a more or less even surface; hind femora somewhat swollen; tergite 3 striated over its greater basal part [sp. n.
(*Teleas?*) *incertus*, 4.
- Middle of mesonotum not thus reticulated; hind femora not swollen; tergite 3 not thus striated 3.
3. Middle of mesonotum more or less distinctly punctured and very shining between the punctures; tergite 3 almost always entirely unsculptured, smooth and shining; if striations occur, as in some varieties, they are very superficial and feeble and are not deepened towards the base of the segment 22. *cyclops*, sp. n.
- Middle of mesonotum conspicuously smooth and unsculptured; tergite 3 with a row of extremely short, puncture-like striations along its entire basal margin 23. *sejus*, sp. n.
4. Postscutellar spine forked at its apex 18. *carus*, sp. n.
- Postscutellar spine simple 5.
5. Wings undeveloped, not extending beyond the apex of tergite 1 6.
- Wings fully developed 7.
6. Entire body except the eyes and funicle bright brownish yellow or honey-yellow; frons rugulose all over; tergite 3 strongly sculptured all over 2. *orion*, sp. n.
- Entire body black; frons entirely smooth and shining; tergite 3 with only a faint, superficial, reticulate sculpture 21. *laius*, sp. n.
7. Entire thorax honey-brown, contrasting very sharply with the black head and abdomen. (Slender species with very long antennæ, the segments hardly, or not at all, shorter than the scape; postscutellar spine long and strong; tergite 3 strongly sculptured all over and with a predominately punctate-reticulate element.) 13. *sperches*, sp. n.
- Thorax black or pitchy black, at the most faintly suffused with reddish at the sides. 8.
8. Mesonotum, at least on its basal half, entirely or virtually smooth and shining. (Species with no trace of parapsidal furrows and with the funicle very slender, the hairs of the funicle slightly to considerably longer than the width of the

- segments and each one standing out more or less separately; tergite 1 conspicuously reddish.) 12. *tityrus*, sp. n.
- Mesonotum everywhere sculptured 9.
9. Tergite 3 more or less quadrate. (Species with the antennæ thicker than usual, considerably longer than the body; hairs of the funicle dense, by no means obviously longer than the width of the segments themselves; mesonotum with fairly large, close punctures, the surface between them strongly shining.) 15. *thoas*, sp. n.
- Tergite 3 strongly transverse 10.
10. Mesonotum shallowly and somewhat confusedly punctate, the surface between the punctures strongly shining 14. *uranus*, sp. n.
- Mesonotum not as above 11.
11. Sculpture of the mesonotum somewhat fine, that is, very finely, superficially, and indeterminately punctate-reticulate, or, at first sight, finely rugose; parapsidal furrows distinct on posterior two-thirds or half of mesonotum, showing as sharp narrow grooves. (Species with the funicle not much longer than the body; tergite 3 regularly striated all over, or, at any rate, without a coarse punctate-reticulate element.) 17. *tiresias*, sp. n.
- Sculpture of mesonotum strong, very closely and determinately wrinkly-punctate; no trace of parapsidal furrows. (Species with tergite 3 strongly sculptured all over and with a coarse, punctate-reticulate element; funicle very long and slender, much longer than the body.) 16. *fons*, sp. n.

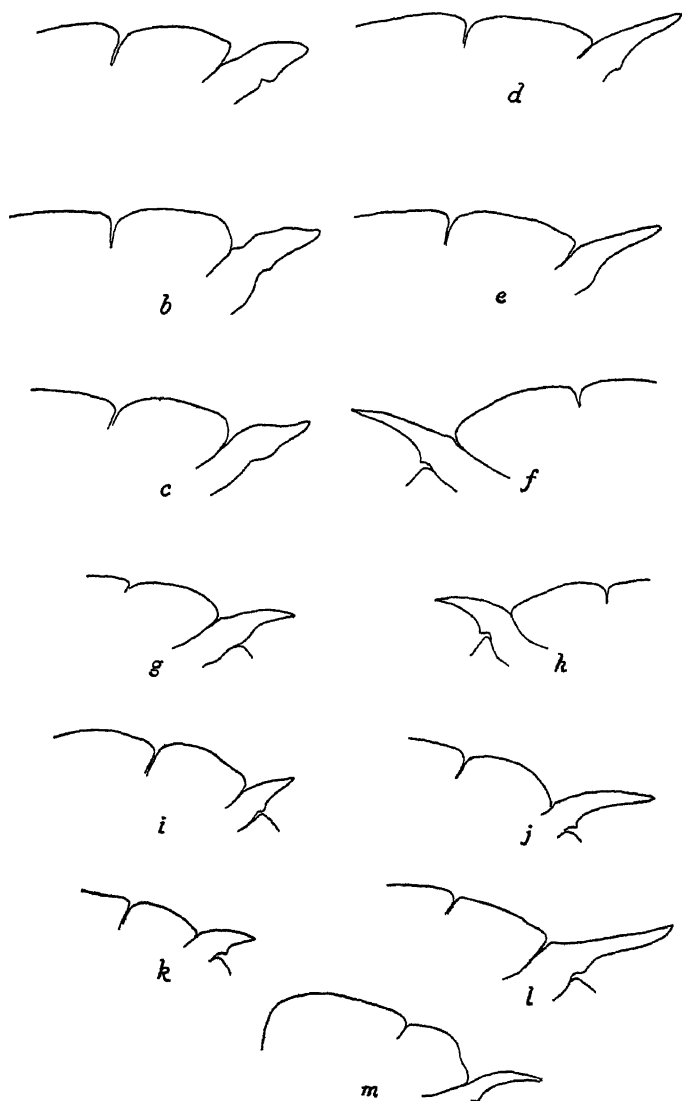
All species have the lateral teeth of the propodeum sharp and well developed, except where the contrary is stated.

1. *Hoplogryon lollius*, sp. n.

♀.—Black with a brownish tinge (often very marked). First and second segments of the funicle conspicuously yellowish white; rest of the antenna nearly black or sometimes markedly brown. Legs yellowish brown, the coxæ and the trochanters in far greater part, or everywhere, paler than the femora.

Head conspicuously wider than the thorax, about 6:5. A fine sharp ridge extends from the anterior ocellus to the antennal insertions. Some of the genal striations extend upwards along the inner orbit of the eye to a level with the top of the eye. Upper half of the frons very shining, more or less punctured all over, but

Fig. 3.



Scutellum and postscutellar process (lateral) of: *a, b, c, Macrogyron pluto*, sp. n., ♂; *d, e, M. echion*, sp. n., ♂; *f, Hoplogryon fons*, sp. n., ♂; *g, H. codrus*, sp. n., ♀; *h, H. uranus*, sp. n., ♂; *i, H. magnes*, sp. n., ♀; *j, H. scepsis*, sp. n., ♀; *k, H. schceneus*, sp. n., ♀; *l, H. thoas*, sp. n., ♂; *m, H. nominus*, sp. n., ♀.

the punctures usually very shallow and ill-defined ; towards the ocelli they sometimes give way to delicate wrinkles, and, again, in some individuals a wrinkled condition of the sculpture tends to displace the punctures on upper third of frons. Posterior (declivous) part of the vertex with a variable amount of fine sculpture, the shininess of the surface varying inversely with the intensity of the sculpture. Eyes large, bare, the shortest distance between them to their width, the head being seen from above, as 4 : 3 ; the malar space is less than one-third the length of the eye. Antennæ long and powerful (fig. 6 e) ; when the head is seen from the side the scape extends conspicuously above the level of the vertex ; funicle 1 and 2 subequal in length, both a little longer and thicker than the pedicel ; funicle 1 is fully twice as long as its apical width ; 1 and 2 are clothed with short silvery-white hairs ; 4 is hardly wider than long ; the entire funicle is gradually thickened from base to apex, so that the club is not clearly differentiated.

Thorax : Mesonotum less than twice as wide as long, about 21 : 14 (this measurement excludes the tegulæ), dull, evenly and as closely as possible, wrinkly-punctate all over ; in small examples the sculpture is less coarse and the surface less dull. Scutellum sculptured all over like the mesonotum. Postscutellar spine long, narrow, sharply pointed, about $\frac{1}{2}$ the length of the scutellum. Lateral areas of the propodeum bare except for a few hairs towards the sides, and with some costæ and coarse reticulations. Wings shortened, hardly extending beyond the apex of tergite 1. Mesopleurum below the sharply defined and even ridge more or less coarsely rugose-punctate.

Abdomen conspicuously longer than wide, about 21 : 14 ; tergite 1 swollen at the base, showing indications of a hump, which tends to be smooth at the base ; 2 rugose-punctate, apart from the strong basal costæ ; 3 subquadrate, hardly wider than long, dull and strongly punctate-rugose all over ; there are no basal striæ on this tergite ; 4 rugose more or less all over.

Length 1.8–2.5 mm.

CAPE PROVINCE (PortSt. John), Nov., 1 ♀ ; Jan.–Feb., 8 ♀♀.

This is a very distinct species, and is easily recognized by the colour of the first and second segments of the funicle.

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 9

2. *Hoplogryon orion*, sp. n.

♀.—Colour: bright honey-yellow, except the eyes and the ocelli which are black and the funicle which is blackish brown.

Head wider than the thorax, 26 : 21 (this measurement includes the tegulæ), much sculptured, and, seen along a line perpendicular to a line between the posterior ocelli, almost exactly twice as wide as long (fig. 7 b); in one small example it is a little less transverse than this. Frons very markedly convex with a smooth space immediately above the antennal insertions; its upper half, and the vertex above, more or less rugose-punctate, but the sculpture is difficult to make out, owing to light refractions produced by the pale colour of the insect. Antennæ thick and powerful for the size of the insect; seen from the side the scape very slightly overreaches the vertex; funicle 1 about $1\frac{1}{2}$ times as long as wide; 2 very slightly shorter than 1; 3 and 4 small, bead-like; club clearly 6-segmented and markedly thick. Eyes small, not much longer than the malar space, about 6:5, and with extremely short, sparse hairs.

Thorax: Mesonotum (measurement excludes tegulæ) about twice as wide as long, evenly and rather strongly—for the size of the insect—sculptured all over; the sculpture is more or less the same as occurs on the frons. Scutellum sculptured like the mesonotum. Postscutellar spine short and sharp, hardly more than half the length of the scutellum. Fore wings short, not reaching beyond apex of tergite 1 and with a dorsal fringe of short bristles. Mesopleural ridge more or less sharply defined.

Abdomen a little wider than the thorax, not much longer than wide, about 24 : 19; tergite 1 about 6 times as wide apically as its medial length; 2 punctate-rugose all over except for the short basal costæ; 3 evenly punctate-rugose all over with only extremely short costæ at base.

Length .8–1.3 mm.

♂.—Differs from the ♀ as follows:—

Antennæ: scape and pedicel honey-yellow like the body; funicle more or less black, fully as long as the body, clothed unevenly with semi-erect, brownish hairs, many of which are curved and which are hardly shorter than the width of the segments; funicle 3 has a well-

developed, keel-like projection beneath; 6 fully three times as long as wide. Eyes slightly smaller, hardly longer than the malar space. In two individuals, the mesonotum shows distinct traces of parapsidal furrows.

Length 1.2 mm.

CAPE PROVINCE (Port St. John), Jan.-Feb., 4 ♂♂, 3 ♀♀.

This species is conspicuously distinct from the other species described in this paper, on account of its bright colour combined with vestigial wings and small eyes.

3. *Hoplogryon marsyas*, sp. n.

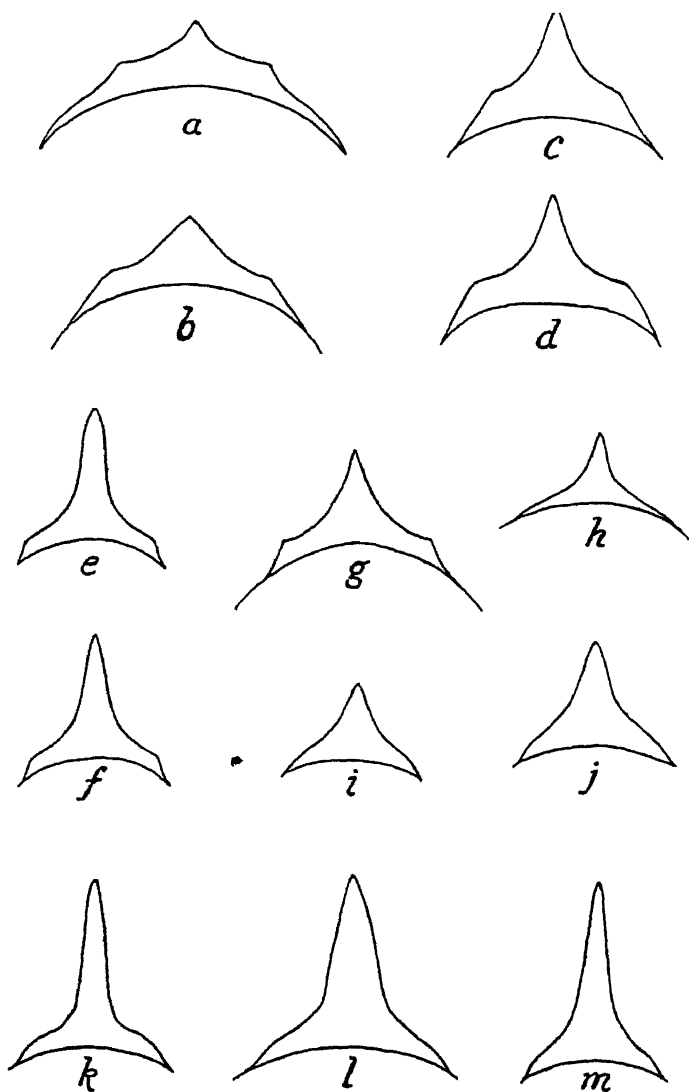
♀.—Black, with the thorax conspicuously reddish. Legs entirely reddish yellow. Abdomen less black than the head and with tergite 1 and the base of tergite 2 much the same colour as the thorax.

Head: Upper half of the frons as well as the vertex between, and to the sides of, the ocelli, finely, evenly, and closely sculptured, the sculpture consisting of tiny ripple-like rugulosity which show a feeble tendency to form themselves into weak longitudinal wrinkles. A fine sharp ridge extends from the anterior ocellus to the antennal insertions. Posterior (declivous) part of the vertex irregularly aciculated. Eyes clothed with microscopic hairs; length of eye to malar space as 4 : 3. Antennæ thick and powerful; funicle 1 nearly twice as long as wide; 2 a little shorter than 1; 3 very slightly transverse; 4 more transverse, but nearer in size to 3 than to 5, so that the club is 6-segmented.

Thorax: Mesonotum a little more than twice as wide as long, 20 : 9, feebly shining, punctured evenly and as closely as possible all over, the punctures of moderate size but ill defined. Scutellum punctured like the mesonotum, but a little less strongly. Postscutellar spine sharp, but not narrow, and about two-thirds as long as the scutellum (fig. 4g). Wings vestigial, in attitude of repose, not reaching beyond the apex of tergite 1. Lateral areas of the propodeum costate. Mesopleural ridge sharply defined.

Abdomen conspicuously wider than the thorax, 9 : 7, not much longer than wide, 11 : 9; tergite 1 very strongly widened from base to apex, about 6 times as wide apically as its medial length; tergite 2 strongly rugulose all over the sides, and also to a greater or less degree right along

Fig. 4.



Postscutellar process (dorsal) of: *a*, *Hoplogryon incertus*, sp. n., ♂; *b*, *Hoplogryon incertus*, sp. n., ♀; *c*, *d*, *Hoplogryon cyclops*, sp. n., ♂♂; *e*, *f*, *H. uranus*, sp. n., ♂♂; *g*, *H. marsyas*, sp. n., ♀; *h*, *H. magnes*, sp. n., ♀; *i*, *H. schœneus*, sp. n., ♀; *j*, *H. codrus*, sp. n., ♀; *k*, *H. sperches*, sp. n., ♂; *l*, *H. scepasis*, sp. n., ♀; *m*, *H. thoas*, sp. n., ♂.

its apical margin ; its medial striations are comparatively short and weak ; 3 strongly transverse, 3 : 2, strongly sculptured all over, the sculpture even, but so indeterminate as best to be described as rugose ; it is striate along its extreme basal margin ; 4 finely rugose all over.

Length 1.6 mm. approx.

E. CAPE PROVINCE (Katberg), Nov., 2 ♀♀.

A very distinct species, easily recognized by its sculptured head, colour, and rudimentary wings.

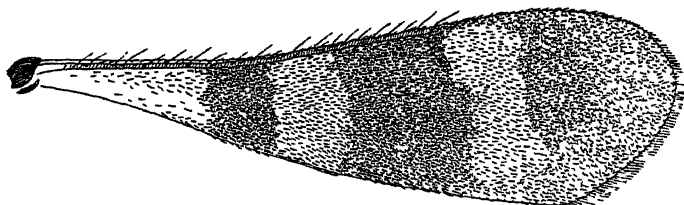
4. *Hoplogryon ninus*, sp. n.

♀.—Black, with the upper half of the head and most of the thorax clothed very conspicuously with short, adpressed, setiform, golden hairs ; on the lower half of the frons the hairs tend to be silvery. First three segments of the funicle clothed with adpressed silvery hairs, which are conspicuous when the segments are viewed at an angle and from the proximal end. Mandibles yellowish with the tips reddish. Femora brownish yellow with a dark apical patch ; tibiae in greater part brown with only the base yellow ; tarsi pale brownish yellow.

Head seen from in front exactly as wide as long, and in this respect characteristic (fig. 7 *d*). Clypeus a little more than twice as wide as the distance between its mid-point and the antennal insertions. Owing to the adpressed hairs, the sculpture of the head is difficult to make out, but the frons is evidently finely longitudinally striated all over. Posterior (declivous) part of the vertex with fine, not very close, aciculations, which extend between the posterior ocelli and the temples. Antennæ long and rather slender (fig. 6 *d*) ; when the head is seen from the side, the scape does not extend, by a considerable distance, to a level with the vertex ; funicle 1 about $2\frac{1}{2}$ times as long as its apical width ; 2 about $1\frac{3}{4}$ times as long as wide ; 3 almost square in outline ; 4 hardly shorter than 3 ; the funicle is gradually thickened from base to apex ; the club is hence not clearly differentiated, rather slender, hardly more than $1\frac{1}{4}$ times as wide as 3. Eyes bare, the shortest distance between them on the frons not much greater than their width, as measured from above, about 14 : 11 ; malar space nearly two-thirds the length of the eye.

Thorax: Sculpture of the mesonotum difficult to make out, owing to the adpressed hairs, but evidently consisting largely of delicate, somewhat broken, longitudinal striations. Scutellum with vague longitudinal striations, which are more or less obscured by the hairs. Post-scutellar spine very short. Propodeum everywhere clothed densely with adpressed, more or less silvery-golden pubescence; lateral teeth wanting; sculpturation of the mesopleura is reduced to a row of oval punctures (reduced costæ) along the posterior margin; there is no mesopleural ridge. Fore wings smoky-grey; they are hyaline at the base and have a broad transverse hyaline band in the neighbourhood of the stigmalis and another at the origin of the marginalis (fig. 5).

Fig. 5.

*Hoplogryon ninus*, sp. n., ♀, fore wing.

Abdomen almost petiolate, nearly twice as long as wide, about 23 : 13. Tergite 1 about as long as its apical width; 2 very evenly striated over its basal third; 3 strongly transverse, 13 : 9, entirely smooth and shining. Length 1.75 mm. approx.

ORANGE FREE STATE (Harrismith), Mar., 1 ♀.

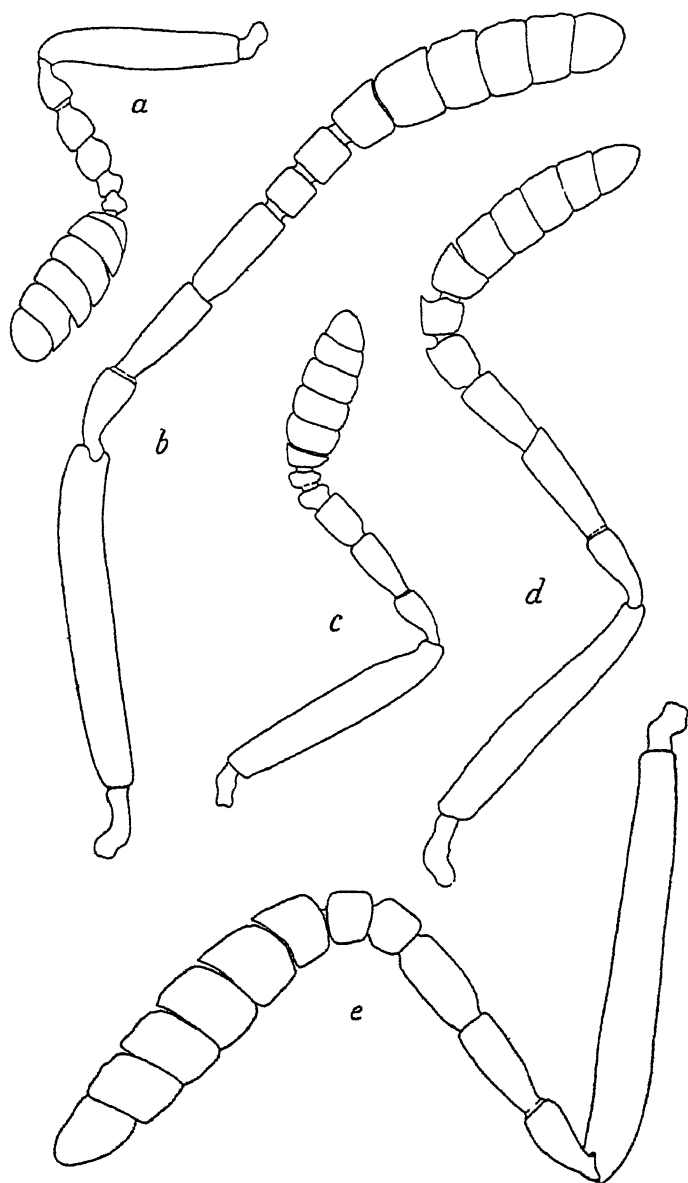
A very beautiful and distinct species, easily recognized by its golden hairs, by the shape of the head as seen from in front, by the pubescence of the first 3 segments of the funicle, and by the smoothness of the third tergite.

5. *Hoplogryon nomius*.

♀.—Black, but not intensely black (this applies chiefly to the thorax). First and second segments of the funicle pale brownish yellow. Legs brownish yellow with the femora and the tibiæ infuscated.

Head (fig. 7 g): Frons dull, sculptured everywhere, more or less finely rugose-punctate with a trace of short longitudinal wrinkles in front of the posterior ocelli.

Fig 6.



Female antennæ of : a, *Trimorus iphias*, sp. n. ; b, *Hoplogryon nomius*, sp. n ; c, *H. incertus*, sp. n. ; d, *H. ninus*, sp. n. ; e, *H. lollius*.

Vertex across the ocelli sharply angled, so that the anterior ocellus and the frons are almost in one plane. Antennæ long and slender (fig. 6 *b*); scape (when the head is seen from the side) extending by about one-third of its length above the vertex, and in this respect characteristic (cf. *ninus*); funicle 1 and 2 clothed with silvery-white hairs, which are very conspicuous in certain aspects; rest of the funicle clothed as usual with excessively short black hairs; funicle 1 about three times as long as its apical width; 2 about as long as 1, but slightly thicker; 3 hardly transverse; 4 roughly square in outline; the whole funicle is gradually thickened from base to apex, so that there is no clearly differentiated club; the club is thicker than in *ninus*. Eyes bare.

Thorax: Mesonotum very strongly arched in front, dull, sculptured all over and clothed with extremely short, adpressed, inconspicuous, reddish-brown hairs; the surface is finely and evenly punctate-reticulate all over. Scutellum feebly transversely arched across its apical third; the surface anterior to the arch is slightly duller and slightly more closely sculptured than the mesonotum; posterior to the arch it tends to become entirely smooth and shining; the smooth surface shows as a fairly well-defined band along the apical margin of the scutellum. Postscutellar spine long, strong, and narrow, fully two-thirds as long as the scutellum (fig. 3 *m*). Lateral areas of the propodeum clothed quite conspicuously with silky whitish hairs; these hairs are certainly sparser towards the posterior margin and are always best seen when the insect is viewed directly from above. Surface below the sharply defined mesopleural ridge dull and more or less rugose-punctate. Fore wings conspicuously smoky, with an ill-defined, transverse, more or less hyaline band in the neighbourhood of the stigmatis.

Abdomen nearly twice as long as wide, 12:7, strongly narrowed towards the base; tergite 1 not much wider apically than its medial length, about 3:2; 2, apart from the rather short, strong striations at base, entirely smooth and shining; 3 transverse, about 6:5; this tergite is fairly densely pubescent laterally, the pubescence short; following segments more or less smooth and shining.

Length 1.7 mm. approx. Type in the Paris Museum.

KENYA (Mt. Elgon), 2400 ft., Mission de l'Omo, R. Jeannel.

This is a very distinct species, quite unlike the more usual forms of *Hoplogryon*. The long antennæ with the two pale proximal segments of the funicle and their clothing of silvery hairs are characteristic.

6. *Hoplogryon magnes*, sp. n.

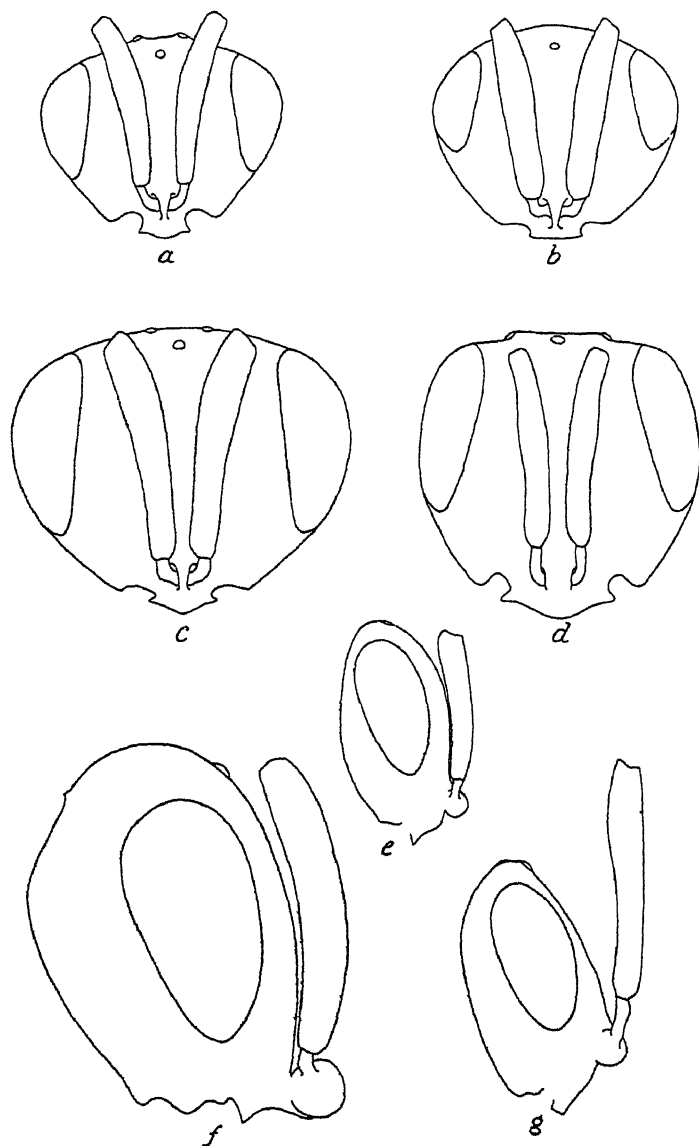
♀.—Black. Legs brownish black, the tarsi paler.

Head (fig. 7 a): Upper half of the frons virtually unsculptured and smooth. Ridge between the anterior ocellus and the antennal insertions entirely wanting, except quite close to the antennal insertions themselves. Posterior (declivous) part of the vertex with fine, more or less aciculate rugulosity. Eyes distinctly clothed with scattered minute hairs. Antennæ (fig. 2 b): funicle 1 and 2 covered with faintly golden-brownish hairs, while the clothing of the following segments consists of brownish-black (virtually black) hairs; funicle 1 fully twice as long as wide apically; 2 hardly shorter than 1; 3 more or less bead-like; 4 distinctly transverse; 4 a little nearer in size to 3 than to 5, so that the club is more or less 6-segmented.

Thorax: Mesonotum quite dull, punctured as closely as possible all over, the punctures not at all sharp, the entire surface having a more or less crinkly appearance (punctate-reticulate). Scutellum dull, punctured all over like the mesonotum. Postscutellar spine very short, not much more than one-third the length of the scutellum (figs. 3 i, 4 h). Lateral areas of the propodeum in greater part entirely smooth and shining; lateral teeth very small. Mesopleural ridge distinct, the surface beneath it more or less rugose-punctate.

Abdomen: Tergite 1 transverse, about twice as wide apically as long medially (fig. 8 c); tergite 2 very characteristic on account of the arrangement of its striations; these are very deep, short, and parallel, the middle ones the longest, but not extending much beyond the middle of the segment; the whole area covered by the striations forms a semicircle, of which the bounding diameter is the basal margin of the segment itself; tergite 2 is otherwise completely smooth and shining; 3 strongly transverse, 8:5, entirely smooth and shining except

Fig. 7.



Female heads of: a, *Hoplogryon magnes*, sp. n.; b, *H. orion*, sp. n.; c, *H. scepsis*, sp. n.; d, *H. minus*, sp. n.; e, *H. schœneus*, sp. n.; f, *Macrogyron cælebs*, sp. n.; g, *Hoplogryon nomius*, sp. n.

for the tiny patch of rugulose sculpture towards each apical lateral corner; this patch is very easily overlooked, and is best seen if the insect is viewed slightly from behind; 4 virtually smooth and shining all over.

Length 1.8 mm. approx.

CAPE PROVINCE (Ceres), Nov., 2 ♀♀, *type* and *paratype*; (Somerset East), Nov., 2 ♀♀.

The two females from Somerset East are considerably smaller than those from Ceres, being only 1.2 mm. approx. in length, and the thoracic sculpture is generally less strong. At first I was inclined to regard them as a separate species, but on carefully examining them I was led to conclude that they were only small varieties. In both, the frons is very slightly more convex than in the Ceres material, but as this is a type of structural variation which I have met with in small examples of other species I do not attach much importance to it.

The species is evidently characterised by the dull, even sculpture of the mesonotum and of the scutellum, by the short postscutellar spine, and especially by the arrangement of the striations of tergite 2.

7. *Hoplogryon œcleus*, sp. n.

This species may be compared with *H. magnes* as follows:—

♀.—Size smaller, equal to that of smaller examples of *magnes*. Tergite 1 sometimes obscurely reddish.

Head: Posterior (declivous) part of the vertex with only a very feeble, indeterminate surface-sculpture. Antennæ: scape, when the head is seen from the side, projecting very slightly above the level of the vertex; funicle 1 about $1\frac{1}{2}$ times as long as wide or a little shorter; 5 small, bead-like; club quite distinctly 6-segmented.

Thorax: Mesonotum feebly shining, finely rugose; on its posterior quarter clearly striated longitudinally. Scutellum smooth and shining more or less all over. Postscutellar process short, more distinctly triangular, as seen from above, than in *magnes*. Mesopleural ridge sharply defined, margined on both sides by a row of costæ-like punctures. Lateral areas of the propodeum bare.

Abdomen: Tergite 2 with normal radiating striations, which more or less cover it; near the apex of the segment there are indications of short, fine, extra ridges between

the striations (a usual condition with this type of striation, cf. carefully *magnes*); tergite 3 entirely smooth as in *magnes*.

Length 1.2 mm. approx.

CAPE PROVINCE (Somerset East), Sept., 1 ♀, Jan., 1 ♀; NATAL (Van Reenen), Nov., 1 ♀; ORANGE FREE STATE (Harrismith), Mar., 1 ♀.

8. *Hoplogryon scepasis*, sp. n.

♀.—Black. Extreme base of scape, radicle, mandibles, and legs honey-brown.

Head wider than the thorax (measured across the tegulae), 9:8 (fig. 7 c). Upper half of the frons, as well as the vertex above, minutely and very feebly punctured, the punctures tending to be arranged in rows; a striate-punctate condition is to be expected within the degrees of sculptural variation of the frons. A very fine ridge extends from the anterior ocellus to the antennal insertions; on either side of this ridge the frons is quite evenly convex. Eyes of normal size, clothed sparsely with excessively short, not readily visible hairs. Antennae long and stout; funicle densely clothed with excessively short, brownish-black (virtually black) hairs; the funicle, hence, appears entirely and evenly dull, and its sculpture is completely obscured; funicle 1 nearly twice as long as its apical width; 2 hardly shorter than 1, but distinctly thicker; 3 and 4 strongly transverse, not bead-like; the whole funicle is gradually thickened from base to apex, so that there is no clearly differentiated club. Posterior (declivous) part of the vertex finely rugulose.

Thorax: Mesonotum dull, as closely punctured as possible all over, the punctures fairly small but not sharp; there is only a very feeble striate element posteriorly. Scutellum punctured all over like the mesonotum, but with a tendency for the punctures to become less crowded medially on the basal half, so that here it is a little shining. Postscutellar spine long and narrow, fully as long as the scutellum (figs. 3 j, 4 l). Lateral areas of the propodeum bare except for a few hairs towards the sides, more or less smooth in the middle, but costate along the anterior margin. Mesopleural ridge sharply defined, the surface beneath it dull and somewhat finely rugose-punctate.

Abdomen. Tergite 1 with its apical width about twice its medial length; tergite 3 strongly transverse, 22.15, striate-punctate all over, the punctate element predominating over the middle part, but the striations distinct along the entire basal margin, 4 finely rugulose all over.

Length 1.9 mm. approx

NATAL (Van Reenen), Oct, 1 ♀.

This species is, to a large extent, characterized by the vestiture of the funicle, though this is a difficult point to appreciate. The strong sculpture of tergite 3 is also distinctive.

[To be continued]

X.—*Notes on Sponges from South Africa, with Descriptions of new Species*. By MAURICE BURTON, M Sc, Department of Zoology, British Museum (Natural History).

A COLLECTION of sponges made by Professor T. A. Stephenson during the course of an ecological survey has revealed the existence of several new species and afforded considerable other additions to the steadily increasing list of species recorded for South Africa. The species represented are as follows :—

From Oude Kraal.

Leucosolenia coriacea (Montagu).

Leuconia crambessa (Hæckel).

— *pumila* Bowerbank

Oscarella lobularis (Schmidt).

Stelletta agulhana Lendenfeld.

Geodia littonalis Stephens

Tethyopsilla metaclada Lendenfeld.

Haliclona crocalypthroides Burton

Callyspongia tubulosa (Esper) Stephens.

Haliclona anonyma (Stephens).

Oceanapia eumitum (Kirkpatrick)

Fibulia ramosa (Ridley & Dendy).

Platychalina multiformis (Stephens).

Gustarra jimbrata Carter.

Mycale macilenta Bowerbank.

Myxilla simplex (Baer).

Issodendoryx isodictyalis var *jacksoniana* (Lendenfeld).

— *stephensoni*, sp. n.

Forcepsa merton Hentschel.

Tedania brondstedti, sp. n.

Iophon proximum (Ridley).

Rhaphidophylus flabellata, sp. n.

Hymeniacidon sanguinea (Grant).

Polymastia littoralis Stephens.

Aplysilla rosea Schulze.

Dysidea fragilis (Montagu).

From St. James.

Leucosolenia coriacea (Montagu).

— *gardineri* Dendy.

— *variabilis* (Haeckel).

— *canariensis* (Macleay).

Leuconia lunulata (Haeckel).

Oscarella lobularis (Schmidt).

Lissodendoryx isodictyalis var. *jacksoniana* (Lendenfeld).

— *arenaria*, sp. n.

Placospongia melobesioides Gray.

Tethya aurantium (Pallas).

From Seaforth.

Spirastrella spinispirulifer (Carter).

From Muizenberg.

Aplysilla rosea Schulze.

SYSTEMATIC NOTES AND DESCRIPTIONS OF NEW SPECIES.

[The great majority of the species given in the faunal list (see above) are either well known in the literature or are referred to in Stephens (1915) or Burton (1933).]

Haliclona ciocalyptioides Burton.

Haliclona ciocalyptioides Burton, 1933. p. 238, fig. 2.

Remarks.—The present specimens are quite typical, except that in one at least the supposedly characteristic papillate oscules are lacking. In this specimen the exhalant apertures are level with the general surface and are composed of groups of five or six openings.

Haliclona anonyma (Stephens).

Siphonochalina anonyma Stephens, 1915, p. 459, pl. xxxix. fig. 6, pl. xl fig. 9.

Reniera saldanhae id. l.c. p. 463, pl. xxxix. fig. 8, pl. xl. fig. 18.

Remarks.—The close similarity between the two species, listed here as synonyms, is very apparent in the present specimens. There is, in fact, every reason to believe that they are simple varieties of the same species.

Genus FIBULIA Carter.

In proposing the name *Plumocolumella* for *Fibulia carnosus* Carter I had assumed that *Fibulia* Carter (1886,

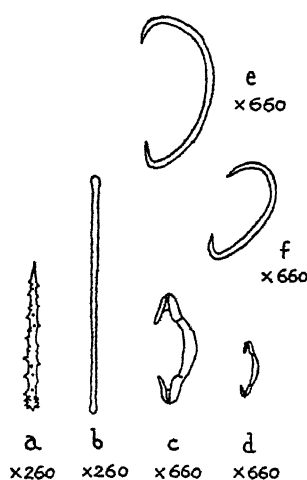
p. 51) was a misprint for *Fibularia* Carter (1882, p. 282). It is even now possible that this is correct, but there is no substantial evidence for believing it to be so. It is here proposed, therefore, to revert to the name *Fibulia* for the species listed by me (1929, p. 424) under *Plumocolumella*.

Genus PLATYCHALINA Ehlers.

In reviving the use of the name *Isodictya*, Dendy (1924) was evidently under the impression that the name was first used by Bowerbank in 1866 for *I. palmata* (Johnston). It dates, however, from 1858, with *I. anomala* Bowerbank as the only species.

Platychalina foliacea (Esper) Ehlers is a lipochelous form of *Homæodictya elastica* (Vosmaer) and, as a consequence, the name *Platychalina* pre-emptes *Homæodictya*.

Fig. 1.



Lissodendoryx arenaria, sp. n.

a, acanthostyle; b, tornote; c and d, isochelæ;
e and f sigmata.

Lissodendoryx arenaria, sp. n.

(Fig. 1.)

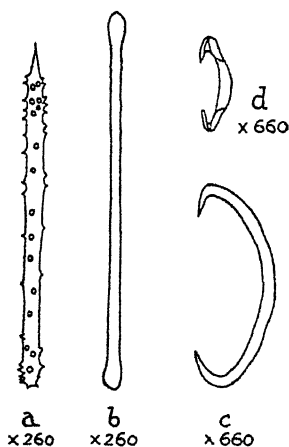
Holotype.—B.M. 35.10.21.5.

Diagnosis.—Sponge massive; surface uneven, marked with meandrine ridges; oscules 2–3 mm. diameter,

scattered on upper surface of body; texture hard, incompressible, friable; colour, in spirit, light brown; skeleton a mass of sand-grains echinated by acanthostyli, $\cdot 07$ by $\cdot 007$ mm. with strongylote to subtylote tornota, $\cdot 11$ by $\cdot 003$ mm., scattered interstitially; microscleres chelæ, $\cdot 021$ and $\cdot 01$ mm. chord, and sigmata, $\cdot 021$ to $\cdot 029$ mm. chord.

Remarks.—The species is the only one belonging to *Lissodendoryx* in which the skeleton is largely displaced by sand.

Fig. 2.



Lissodendoryx stephensoni, sp. n.

a, acanthostyle; b, tornote; c, sigma; d, isochela.

Lissodendoryx stephensoni, sp. n. (Fig. 2.)

Holotype.—B.M. 35.10.21.6.

Diagnosis.—Sponge massive or massively flabellate; surface smooth, but uneven, or markedly shaggy; oscules small, numerous, along upper margins of body; texture firm, slightly compressible, inelastic; colour, in spirit, yellowish white; skeleton an isodictyal reticulation, with uni- to trispicular mesh, of acanthostyli, $\cdot 16$ by $\cdot 008$ mm.; dermal tornota, with equal ends, tylote, $\cdot 18$ by $\cdot 005$ mm.; chelæ, $\cdot 022$ mm. chord, and sigmata $\cdot 045$ mm. chord.

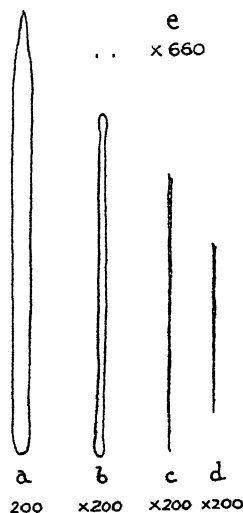
Remarks.—The species most nearly resembles *L. cratera* (Row), from the Red Sea, but differs in details of the spiculation as well as the absence of specialised pore-areas.

Tedania brondstedti, sp. n. (Fig. 3.)

Holotype.—B.M. 35.10.21.1.

Diagnosis.—Sponge irregularly massive, with tendency to produce low digitate processes; surface uneven; oscules not apparent; texture firm, compressible, inelastic;

Fig. 3.



Tedania brondstedti, sp. n.

a, style; b, tornote; c and d, onychæta; e, head of tornote.

colour, in spirit, pale yellow; skeleton of styli, .28 by .007 mm.; tornota, with smooth oval heads, .22 by .004 mm.; microscleres onychata, roughened, anisoxeote, of two sizes, .18 (rare) and .11 mm. long.

Rhaphidophlus flabellata, sp. n. (Fig. 4.)

Holotype.—B.M. 35.10.21.3.

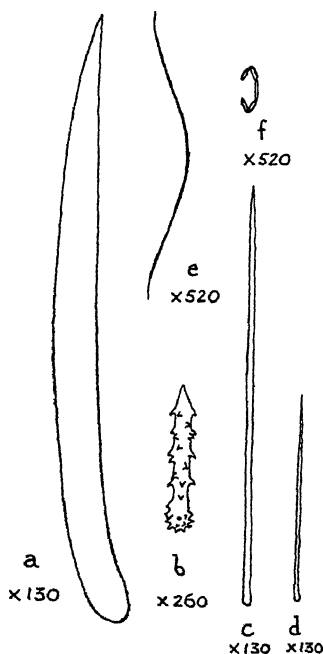
Diagnosis.—Sponge erect, massively flabellate; surface smooth, even, minutely hispid, marked by branching

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 10

On Sponges from South Africa.

subdermal canals running from near base to outer margin ; oscules 2-3 mm. diameter, irregularly scattered on upper margins of sponge ; texture firm, compressible, resilient ; colour, in spirit, pale yellowish white ; skeleton composed of ascending fibres, cored by principal and auxiliary spicules, connected at irregular intervals by single transversely-arranged principal spicules, and echined profusely by acanthostyli ; in distal ends of ascending fibres,

Fig. 4.



Rhaphidophus flabellata, sp. n.

a, style ; b, acanthostyle ; c, auxiliary subtylostyle ;
d, dermal subtylostyle ; e, toxon ; f, isochela.

auxiliary spicules become more numerous ; dermal skeleton of outwardly-directed tufts of dermal auxiliary spicules ; larger auxiliary spicules, chelæ, and toxa scattered interstitially.

Spicules :—

- (1) Principal styli, $\cdot 65 \times \cdot 035$ mm.
- (2) Larger auxiliary subtylostyli, $\cdot 4 \times \cdot 014$ mm.

- (3) Dermal auxiliary subtylostyli, $\cdot 2 \times \cdot 004$ mm.
- (4) Echinating acanthostyli, $\cdot 07 \times \cdot 01$ mm.
- (5) Isochelæ, $\cdot 011$ mm. chord.
- (6) Hair-like toxa, $\cdot 07$ to $\cdot 2$ mm. long.

LIST OF LITERATURE REFERRED TO.

- BOWERBANK, J. S. 1858. "On the Anatomy and Physiology of the Spongiadæ." Phil. Trans. London, cxlviii. pp. 279-332, pls. xxiii.-xxvi.
- . 1866. "A Monograph of the British Spongiadæ.—II." London, 8vo, 388 pp.
- BURTON, M. 1929. "Porifera.—Part II. Antarctic Sponges. British Antarctic ('Terra Nova') Exped. 1910." Natural History Rep., Zoology, vi. 4, pp. 393-458, 5 pls., 9 figs.
- . 1933. "Report on a small Collection of Sponges from Stil Bay, South Africa." Ann. & Mag. Nat. Hist. xi. pp. 235-244, 5 figs.
- CARTER, H. J. 1882. "Some Sponges from the West Indies and Acapulco." Ann. & Mag. Nat. Hist. ix. pp. 266-301, 346-368.
- . 1886. "Descriptions of Sponges from the Neighbourhood of Port Phillip Heads, South Australia." Ann. & Mag. Nat. Hist. xvii. pp. 40-53.
- DENDY, A. 1924. "Porifera.—Part I. British Antarctic ('Terra Nova') Exped., 1910." Natural History Rep., Zoology, vi. 3, pp. 269-392, pls. i.-xv.
- STEPHENS, J. 1915. "Atlantic Sponges collected by the Scottish National Antarctic Expedition." Trans. Roy. Soc. Edinburgh, l. pp. 423-467, pls. xxxviii.-xl.

XI.—*A new Species of Euphæa (Odonata)*. By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

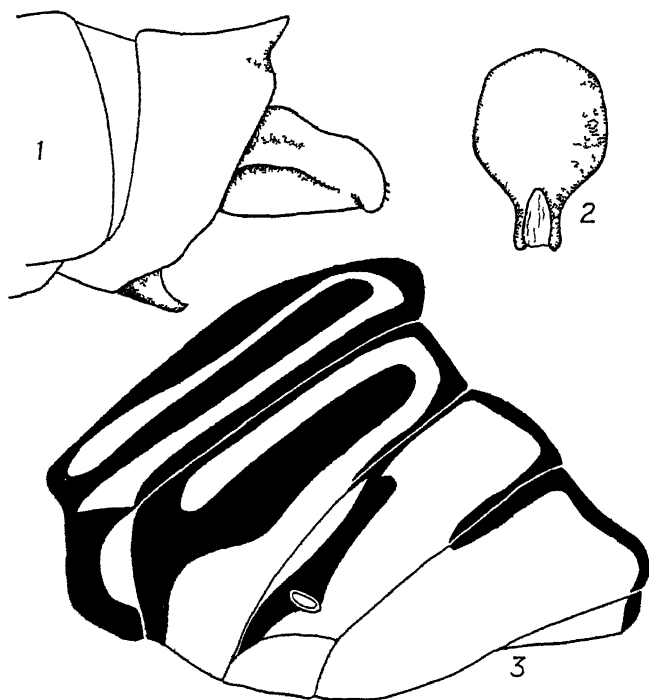
THIS handsome species has remained for some years amongst the accessions in the British Museum. From its colouring I was at first inclined to place it in *Allophæa* Fraser, but, in view of the difference in sculpture of the vesicle and the tendency towards an opaque patch in the apical area of the wings, I have decided to place it in *Euphæa*.

Euphæa superba, sp. n. (Figs. 1-4.)

♂.—A large golden-brown-winged species, with obscure brown suffusion at the apices of the wings. Labrum, anteclypeus, postclypeus, and genæ shining jet-black, anterior margin of labrum narrowly bordered with reddish

brown, anteclypeus with a patch of obscure reddish brown. Remainder of the head dull black, with the exception of a narrow line of reddish brown on each side between the posterior ocelli and the bases of the antennæ. Prothorax dull black, marked with reddish brown. Synthorax reddish brown, marked with black as in fig. 3:

Figs. 1-3.

*Euphæa superba*, sp. n., ♂.

- 1, apex of abdomen from side; 2, vesicle from beneath;
3, diagram of colour-pattern of thorax, from side.

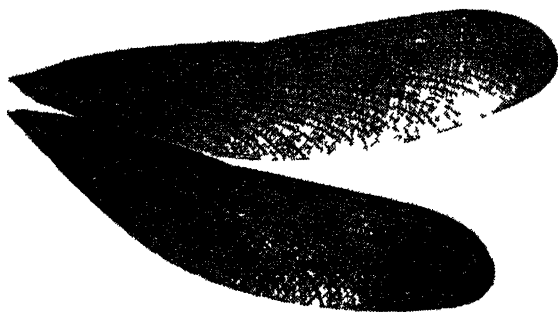
ventrally pale yellowish brown. Legs piceous, becoming reddish on their flexor surfaces.

Wings (fig. 4) hyaline golden-brown, apices with a brownish suffusion, extending in the anterior to about halfway along the pterostigma and in the posterior to a few cells beyond the pterostigma. The colour of the

membrane is stronger in the costal and subcostal areas towards the bases of the wings. The whole of the costa and the basal portions of the other longitudinal veins black, pterostigma dark reddish brown, other veins and cross-veins, particularly when viewed along the plane of the wings, brick-red.

Abdomen brownish red, shading to blackish on segments 7-10. Vesicle depressed, flask-shaped, shining, without transverse grooving. Margin of the tenth tergite raised in the centre, appearing triangular from the side and quadrangular from behind. Superior appendages piceous, about as long as the tenth segment, conforming to the shape usual in the genus.

Fig 4



Euphæa superba, sp n, ♂
Wings, $\times 1\frac{1}{4}$. (Phot D E Kimmuns.)

Length of abdomen 42 mm., of fore wing 40 mm., of hind wing 37.5 mm.

Tonkin (Brit. Mus. Reg. no. 1902-102). (Purchased from H. Fruhstorfer.)

Holotype ♂, 1 paratype ♂, in the British Museum Collection.

This species differs from the other yellow-winged species in its greater size, denser reticulation, brownish markings at the wing-apices, and the smooth surface of the vesicle.

XII.—*The Beetles belonging to the Lamellicorn Genus Chiron.* By GILBERT J. ARROW, British Museum (Natural History).

TWELVE species are attributed to the very peculiar and isolated genus *Chiron* by Adolf Schmidt in the Junk Catalogue of Coleoptera, but, having fortunately been able to compare the original types of nearly all of these, I am able to state that the names there given belong in reality to less than half that number of distinct forms. I am indebted to the kindness of Prof. G. D. Hale Carpenter, Monsieur P. Lesne, and Monsieur R. Oberthür for the opportunity of studying these specimens (the types of Westwood, Fairmaire, and Harold respectively).

Of the twelve catalogued species one (*ulcithorax* Perty) is evidently, from the description, a member of the genus *Figulus*, belonging to the family Lucanidæ. Several other names in the list are synonyms of the common and very widely distributed *Chiron cylindrus* F., which ranges from Burma and Ceylon to Tropical Africa. So wide a range was considered improbable by last century writers, who accordingly described the same form repeatedly. Of the four names bestowed by Westwood in his anonymously published 'Catalogue of the Lucanoid Coleoptera' (generally attributed to Hope) two, *assamensis* and *senegalensis*, belong to this species, as does also *C. kelleri* Fairmaire, from Somaliland. *C. volvulus* Klug, from East Africa, there is no reason to doubt, is also *C. cylindrus*, which occurs in many parts of East Africa and evidently crosses the continent from side to side.

The South African *C. capensis* Westw. is very closely related to *C. cylindrus*, but entirely black, including the legs and lower surface. It is recognisable also by the dilatation of the head just in front of the eyes and by the puncturation of the pygidium, which bears only a scanty series of marginal punctures, instead of the numerous close punctures upon that of *C. cylindrus*. *Chiron puncticollis* Har., of which M. Oberthür has kindly lent me the type, is identical with *C. capensis*.

Very closely related to these two species is the Madagascan *Chiron hovanus* Fairm. Although not larger, this is a much more stoutly built insect, with relatively

shorter and broader elytra. The legs and lower surface of the two original specimens from the Fairmaire collection in the Paris Museum are red, and the pygidium bears fairly numerous large punctures. The thoracic punctures of *C. hovanus* are finer than those of the two related forms.

These three species differ from the rest by the peculiar mandibles, of which the left one is large and very blunt, while the other is shorter, more rounded externally, and very sharp at the tip. In the remaining species the two mandibles are equal and acutely pointed.

C. gambianus Westw. appears to be a very small specimen of *C. grandis* Gory, but not smaller than an otherwise typical example in M. Oberthür's collection. The mandibles of the Westwood type are rather short and blunt, due probably to wearing down.

C. gravis Pér., from Basutoland, is evidently similar to *C. rhodesianus*, here described. The pronotum, covered with very fine and very closely set punctures equally distributed throughout, should enable it to be easily recognised. This species is only known to me from the original description, but, for the sake of completeness, I have included it in the following table, which includes also two hitherto undescribed forms.

It will be seen that, although first discovered in India, where seemingly it most abounds, as represented by the very common species *C. cylindrus*, the genus must be regarded as an African one, with a representative in Madagascar and with its predominant species distributed throughout a large part of Africa and extending by way of the Nile Valley into India.

Key to the Species of Chiron.

- | | |
|---|-----------------------------|
| 1 (6). Mandibles unequal: head bearing two tubercles. | |
| 2 (5). Elytra long: punctures of pronotum not very fine. | |
| 3 (4). Head not dilated before the eyes: pygidium well punctured | <i>cylindrus</i> F. |
| 4 (3). Head dilated before the eyes: pygidium very scantily punctured | <i>capensis</i> Westw. |
| 5 (2). Elytra shorter: punctures of pronotum very fine. | <i>hovanus</i> Fairm. |
| 6 (1). Mandibles equal and symmetrical: head bearing three tubercles | |
| 7 (10). Pronotum very unequally punctured. | |
| 8 (9). Punctures of pronotum dense in front.... | <i>rhodesianus</i> , sp. n. |

- 9 (8). Pronotum almost unpunctured..... *lævicollis*, sp. n.
 10 (7). Pronotum entirely and evenly punctured.
 11 (12). Pronotum very finely punctured *gravis* Péring.
 12 (11). Pronotum not very finely punctured..... *grandis* Gory.

Chiron rhodesianus, sp. n.

Niger, nitidus, tarsi antennisque rufis; cylindricus, modice angustus, capite toto crebre rugoso, antice trituberculato, mandibulis duabus æqualibus, apice subacuminatis, labro antice leviter emarginato; pronoto quam latitudinem longiori, antice crebre sat fortiter, postice sparsim et minutissime, punctato, angulis anticis acutis, posticis nullis; elytris profunde crenato-striatis, intervallis leviter convexis; metasterno lævi, medio toto canaliculato, abdominis lateribus pygidioque crebre granulatis.

Long. 12 mm.; lat. max. 4 mm.

N.E. RHODESIA: Upper Luangwa R. (*S. A. Neave*, Aug.).

The single specimen is a female, the pygidium being small, but the last two ventral sternites are only moderately enlarged, much less so than in *C. grandis*. It is less elongate than *C. grandis*, the pronotum being narrower but the elytra relatively shorter. The head is almost the same, but the mandibles are less sharply produced at the tips. The puncturation of the pronotum is unlike that of any other species. The punctures upon the anterior part are rather large and very close, while those of the posterior part are extremely fine and scanty. It is probable that the species is most closely related to *C. gravis* Pér., which is unknown to me, but in that the whole pronotum is covered with closely set punctures. The elytral intervals are distinctly convex.

Chiron lævicollis, sp. n.

Niger, nitidus, tarsi antennisque rufis; cylindricus, angustissimus, capite toto crebre granulato-rugoso, antice minute trituberculato, mandibulis æqualibus, apice acuminatis, labro antice leviter emarginato; pronoto quam latitudinem paulo longiori, fere impunctato, punctis nonnullis minutis prope margines anticum et laterales, angulis anticis acutis, posticis nullis; elytris sat fortiter crenato-striatis, intervallis dorsalibus planis; mesosterno postice metasternoque lævibus, hoc medio toto canaliculato, abdominis lateribus crebre granulatis, pygidio sublævi, punctis magnis piliferis nonnullis.

Long. 11.5 mm.; lat. max. 3.5 mm.

KENYA : Sabaki, Lower Tana R. (*Turner & McArthur*, April-May).

This species also is described from a single specimen, which has been presented by the Nairobi Museum to the British Museum.

It appears to be a female, the last two ventral segments being enlarged and the pygidium small. It resembles *C. rhodesianus*, but is of narrower form, with proportionately longer elytra. It differs also from that and all the other species of the genus known to me by its almost unpunctured pronotum, which bears only a few scattered punctures in the front angles and near the front margin. The elytral striæ are only very feebly punctured and the dorsal intervals are flat. The pygidium is clothed with fine hairs at its base, but the remaining surface is almost smooth, although bearing about six large pits, from which arise very long stiff bristles.

XIII.—*Two new African Hemerobiidæ (Neuroptera)*. By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

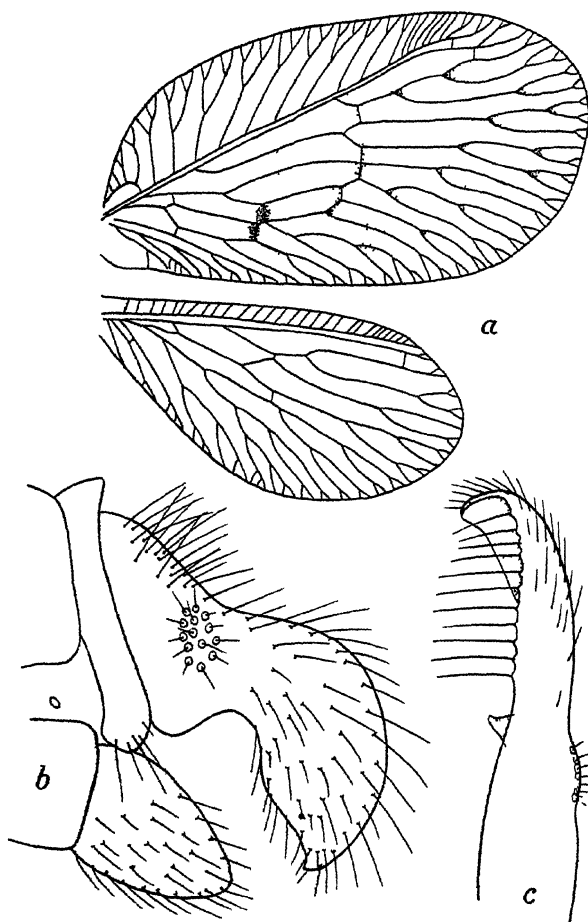
Notiobiella hargreavesi, sp. n. (Figs. 1-2.)

♂.—Head creamy-yellow, marked with orange-yellow on the vertex; palpi brown, antennæ pale tawny, eyes dark grey. Prothorax a little longer than broad, tapered towards the anterior margin, yellowish brown, marked with orange-yellow or entirely yellowish. Meso- and metathorax similarly marked. Legs pale, faintly greenish, median and posterior tibiæ somewhat inflated. Abdomen yellowish. Superior appendages elongate, broad at base, constricted about midway, and dilated and turned downward at apex, which is acute. In dorsal aspect parallel-sided, lower apical margin twisted slightly inward, upper margin towards apex bearing a row of stiff hairs on stout bases, directed inward. Lower margin at base turned inward and produced to form a small pointed process. Ninth sternite produced and rounded.

Tenth sternite large, the arch-shaped framework very narrow dorsally, dilating towards its lower margins, which are backwardly produced to form long curved spines, overlapping each other at their apices. Attached to the upper part of the arch by a pair of slender arms is a median

process. which terminates in two short, divergent, toothed fingers and supports a large membranous structure Basally this is ovoid, almost filling the cavity

Fig 1



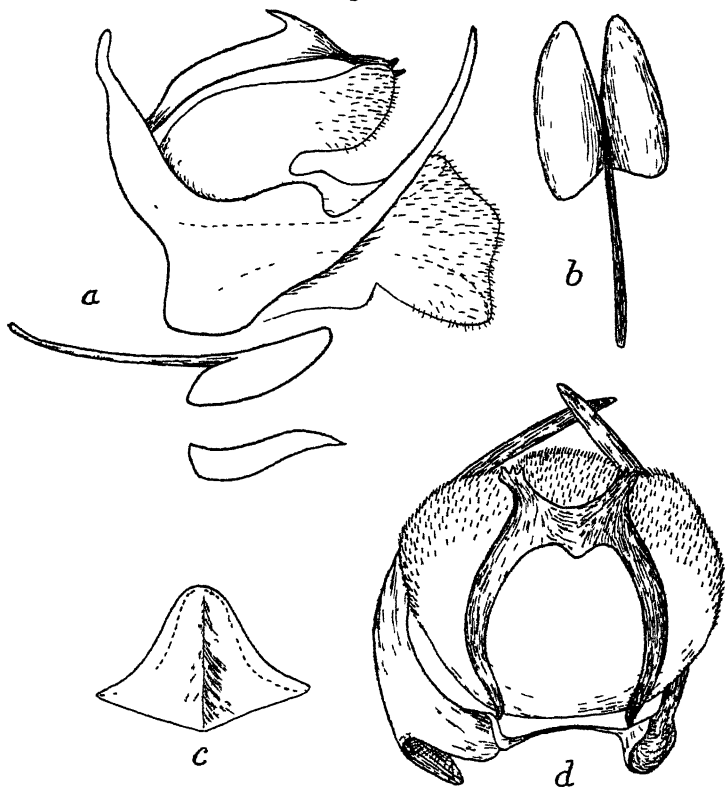
Notobiella hargreavesi, sp n, ♂.

a, wings, b, apex of abdomen from side,
c, superior appendage from behind

between the median process and the arched framework.
Its upper margin is covered with microscopic setæ, and

its lower formed into a truncate tube, the surface covered with minute spinules. Parameres with a slender fused stem and large elongate-oval apices. Hypandrium kite-shaped in dorsal aspect, broadest behind, outer margins reflexed and sinuous.

Fig. 2.



Notrobiella hargreavesi, sp. n., ♂.

a, tenth sternite, parameres, and hypandrium from side; b, parameres from above; c, hypandrium from above; d, tenth sternite from above.

Wings hyaline, venation pale, anterior wing with faint clouding of brown, neuration and pattern as in fig. 1 a.

	mm.
Length of anterior wing	6.25
Length of posterior wing	4.5

Sierra Leone : Njala, 11. i. 33, 11. ii. 34 (*E. Hargreaves*).

Type ♂, paratype ♂, in British Museum (Nat. Hist.), presented by the Imperial Institute of Entomology. There is also a female from Njala, 22. iii. 34, which probably belongs to this species.

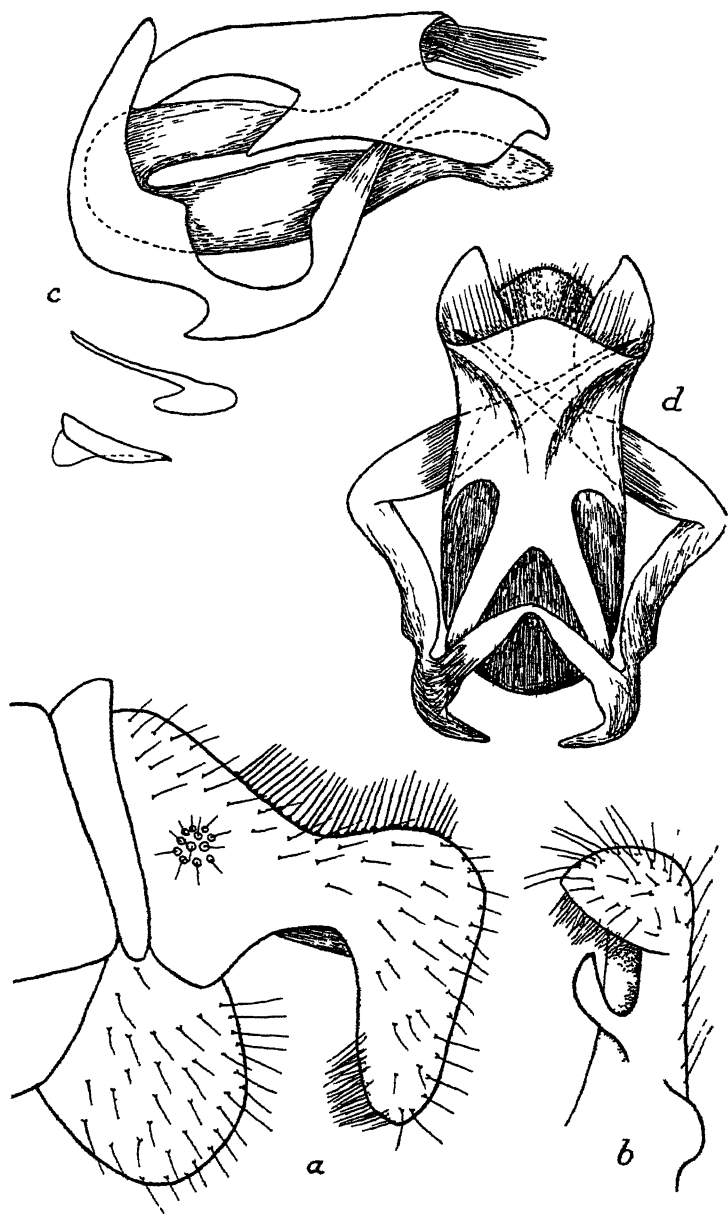
This species somewhat resembles *N. nitidula* Navás (British East Africa), but differences in venation, particularly the basal branch of the radius and the costal area in the anterior wing, should suffice to separate them. The species, by virtue of the closely placed sub-costa and radius is placed in the genus *Notiobiella* as restricted by Dr. Banks in 'Psyche,' xxxix. p. 104 (1932). It will not be out of place to point out here that, judging by his figure, Navás's *Notiobiella congensis* (Rev. Zool. Bot. Afr. xxi. p. 129, 1931) should be transferred to the genus *Annandalia* Needham.

Notiobiella vicina, sp. n. (Fig. 3.)

♂.—General appearance closely resembling that of *N. turneri* Kimmins. Rather larger, more greenish in colour. Wing-venation much as in that species, wings less marked. Superior appendage (fig. 3*a*) long, broad at the base, its lower basal angle somewhat produced; a strong constriction at about mid-length of the appendage, the apex much dilated downward at right-angles. Upper margin of the appendage has a fringe of bristles, and there is a tuft of fine hairs near the apex. From the lower inner margin, near the constriction, there arises a hook-like process directed inward and backward, its apex acute. Ninth sternite large and rounded. Tenth sternite large, the arch-shaped framework rather narrow dorsally, and bearing at each lower angle a stout spine directed upwards and inwards, crossing the other spine. Median process long, the lateral margins produced beyond the apex, which is obtuse from above and carries two tufts of bristles. From this apex is suspended a large membranous structure, folded on itself within the tenth sternite, its apex covered with fine setæ. Parameres inconspicuous, consisting of a slender fused stem and dilated ovate apices. Hypandrium kite-shaped in dorsal aspect, in lateral shaped like the prow of a boat, with reflexed lateral margins.

	mm.
Length of anterior wing	7.5
Length of posterior wing	5.5

Fig. 3.



Notiobiella vicina, sp. n., ♂.

a, apex of abdomen from side; *b*, superior appendage from beneath;
c, tenth sternite, parameres, and hypandrium from side; *d*, tenth
 sternite from

Africa, Congo-Rhodesian Border (*Dr. H. S. Evans*).

Type ♂, Niankasa, 14. ix. 29, allotype ♀, Tshinsenda, 8. x. 28, in the British Museum, presented by the Imperial Institute of Entomology.

This species is closely related to *N. turneri* Kimmins, from Cape Province, but I think the following differences will suffice to separate the two species, at least the males:—Superior appendage comparatively shorter, more constricted midway, and the apex more abruptly dilated downward; process of lower margin stouter. Marginal fringe of bristles and apical tuft of hairs absent in *turneri*. Apex of the median process with two tufts of hairs (absent in *turneri*).

XIV.—*The Dates of Publication of "C. H. Küster and W. Kobelt's Monograph of Spondylus und Pecten" in Volume 7, part 2, of the 'Systematisches Conchylien-Cabinet.'* By LEO GEORGE HERTLEIN, Ph.D., Department of Paleontology of the California Academy of Sciences.

VARIOUS dates of publication have been cited by authors for different portions of the Monograph of *Spondylus* and *Pecten* by Küster and Kobelt. A copy of this valuable work which was recently secured from Herr W. Junk, bookdealer in 's Gravenhage, Netherlands, lacked the original covers, and consequently information regarding the dates of publication had to be sought elsewhere. Appreciation is here expressed to Miss Veronica J. Sexton, Librarian of the California Academy of Sciences, who corresponded with Mr. H. W. England, Clerk in charge of the Zoological Library of the British Museum of Natural History. Mr. England furnished a collation of the work and gave permission to publish it in the present paper, he having secured authority therefore from Dr. W. T. Calman, Keeper of the Department of Zoology. The co-operation of these men is deeply appreciated.

The work is in quarto, and constitutes, as indicated on the first title-page, a part of:—

"Systematisches | Conchylien-Cabinet von | Martini
und Chemnitz. | In Verbindung mit Dr. Philippi,
Dr. Pfeiffer, Dr. Dunker, Dr. Römer, Weinkauff, Clessin,
Dr. Brot, | Th. Löbbecke und Dr. v. Martens | neu

herausgegeben und vervollständigt | von | Dr. H. C. Küster, | nach dessen Tode fortgesetzt von | Dr. W. Kobelt. | Siebenten Bandes zweite Abtheilung. | Nürnberg, 1888. | Verlag von Bauer & Raspe. | (Emil Küster.)"

The second title-page reads as follows :—

"Die | Gattungen | Spondylus und Pecten. | Begonnen | von | Dr. C. H. Küster, | fortgesetzt und beendet | von | Dr. W. Kobelt | in Schwanheim. | Nürnberg, 1888. | Verlag von Bauer & Raspe. | (Emil Küster.)"

The publication contains, in addition to the two title-pages, 296 pages (in signatures 1-37), and 73 coloured plates, numbered 1 to 8 and 8 *a* to 72.

This excellent monograph appeared in 15 Lieferungen. The dates of issue and the contents of the parts given in this collation were taken from the original paper wrappers by Mr. England, except in the cases of those numbered 41, 45, 161, 163, 165, 166. The information regarding these was obtained from the manuscript notes in the British Museum copy made by Mr. E. A. Smith, Curator of Mollusks in the British Museum of Natural History from 1867-1913. Both title pages bear the date 1888. Pages 1-128 were written by Küster and were published during the years 1858 and 1859. Plates 1 to 36, also by Küster, appeared from 1842 to 1859. The remainder of the book, pages 129 to 296 and plates 37 to 72 are by Kobelt and appeared from 1886 to 1888.

According to the Catalogue of the Library of the British Museum of Natural History, a 12-page pamphlet issued in 1905 contains a history of the Conchylien-Cabinet, and of the conchologists who collaborated with Küster and Kobelt. This pamphlet is not readily available for consultation in America, but it does not contain a collation of the work.

Collation of Küster and Kobelt's
"Spondylus und Pecten."

Pages.	Plates.	Lieferung.	Date.
	1, 2, 3, 4, 5, 14	38	1842.
	11, 12, 13	41	1843 (teste E. A. Smith).
	6, 15, 18	45	1844 (teste E. A. Smith).
	7, 16, 17	75	1848.
	8, 8 <i>a</i> , 9, 10	161	1858 (teste E. A. Smith).
1-16	19, 20, 21, 22, 23, 24	163	1858 (teste E. A. Smith).

Pages.	Plates.	Lieferung.	Date.
17-32	25, 26, 27, 28, 29, 30	164	1858.
33-80		165	1859 (teste E. A. Smith).
81-128	31, 32, 33, 34, 35, 36	166	1859 (teste E. A. Smith).
129-152	37, 38, 39, 40, 41, 42	342	1886.
153-176	43, 44, 45, 46, 47, 48	349	1887.
177-200	49, 50, 51, 52, 53, 54	350	1887.
201-224	55, 56, 57, 58, 59, 60	354	1887.
225-256	61, 62, 63, 64, 65, 66	357	1888.
257-296	67, 68, 69, 70, 71, 72	358	1888.

BIBLIOGRAPHICAL NOTICE.

A Manual of the common Invertebrate Animals exclusive of Insects. By H. S. PRATT. Thoroughly revised edition. xviii + 854 pp. 974 text-figs ($5\frac{1}{2} \times 9\frac{1}{2}$ inches). Philadelphia: P. Blakiston's Son & Co., Inc., 1935.

THE first edition of this book was published in 1916 (although that date cannot be discovered from the volume before us), and the fact that a revised edition is now called for shows that the work has met a want felt by many teachers of Zoology in North America—the want, namely, of a book of convenient size to which reference can be made to ascertain approximately the name and systematic position of any common invertebrate. The vertebrates and the Insects, being more or less adequately dealt with elsewhere, are omitted from this volume.

As explained in the Preface, the general plan of the work is that of Leunis' 'Synopsis,' a book which used to be found on the shelves of every zoological laboratory. Leunis, however, dealt with the animals of the whole world, while Pratt includes, as a rule, only those found in North America. Nevertheless, the fauna of that region is so large and varied and has been so well studied, that most teachers will find this a very useful work of reference.

Although the author acknowledges his obligations to a large number of specialists who have helped him with various groups, the labour of compiling the work must have been vast and the checking of every statement impossible. It would be ungracious therefore to dwell on the mistakes that the specialist may discover in the sections in which he is interested. The book can be recommended as well-fitted to supply the systematic background which is lacking in much academic teaching of zoology at the present time.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 98. FEBRUARY 1936.

XV.—*The African Species of Teleasinae (Hym., Proctotrupoidea, Fam. Scelionidae)*. By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History).

[Concluded from p. 141.]

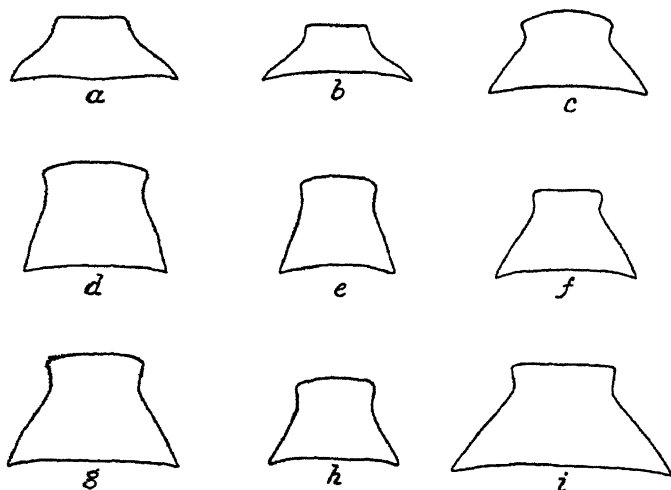
9. *Hoplogryon schæneus*, sp. n.

♀.—Black, with the legs reddish brown. A stout medium-sized species.

Head a little, but quite obviously, wider than the thorax, about 21 : 20 (figs. 1 *d*, 7 *e*). There is no trace of a ridge between the anterior ocellus and the antennal insertions. Frons in greater part entirely smooth and shining; immediately in front of, and to the sides of, the anterior ocellus, the surface becomes finely punctate, the punctures close, not sharp, and the surface between them finely alutaceous. Vertex between the ocelli as closely punctured as possible, but the surface appearing dull. Posterior (declivous) part of the vertex more or less finely rugulose with a tendency towards an aciculate condition. Eyes bare. Antennæ (fig. 2 *e*): when the head is seen from the side, the scape does not reach by a considerable distance to the level of the top of the eye; funicle 1 about $1\frac{1}{2}$ times longer than wide; 2 hardly longer than wide; 3 and 4 strongly transverse; club clearly 6-segmented.

Thorax: Mesonotum exactly twice as wide as long (this measurement excludes the tegulæ), shining, shallowly and closely punctate, the surface between the punctures finely sculptured; the punctures are, on the whole, ill defined and very superficial. Scutellum sculptured more or less like the mesonotum, but becoming smooth and shining on its mid-basal part. Postscutellar spine very sharp, not narrow, and about two-thirds the length of the scutellum (figs. 3 *k*, 4 *i*). Lateral areas of the propodeum bare, costate, but the costæ obliterated medially. Area beneath the well-defined mesopleural ridge in greater part rugose.

Fig. 8.



First abdominal tergite of: *a*, *Hoplogryon codrus*, sp. n., ♀; *b*, *H. schoneus*, sp. n., ♀; *c*, *H. magnes*, sp. n., ♀; *d*, *e*, *H. cyclops*, sp. n., ♂♂; *f*, *H. sperches*, sp. n., ♂; *g*, *h*, *H. incertus*, sp. n., ♂♂; *i*, *H. sejus*, sp. n., ♂.

Abdomen but little longer than wide, about 9:7; tergite 1 nearly 3 times as wide apically as its medial length (fig. 8 *b*); 3 strongly transverse, 7:4, striated over its greater medial part; the striæ are somewhat wrinkled and feeble beyond the basal third of the segment; 4 finely sculptured over most of its basal half.

Length 1.4 mm.

E. CAPE PROVINCE (Katberg), Oct., 1 ♀.

This species is perhaps characterized by the rather short antennæ and by the strong punctate element in the sculpture of the frons and of the vertex. The shortness of the second funicular segment appears to be distinctive, but some allowance should be made for individual variation.

10. *Hoplogryon codrus*, sp. n.

♀.—Black, with the mandibles and the legs yellowish brown.

Head, seen along a line perpendicular to an imaginary line drawn between the posterior ocelli, strongly transverse, very slightly more than twice as wide as its greatest length, 17 : 8. Entire frons (except for a small smooth space above the antennal insertions) and vertex between and to the sides of the ocelli finely and evenly sculptured, the sculpture consisting of tiny ripple-like rugulosities which show a marked tendency (on the frons) to form themselves into feeble longitudinal wrinkles. Posterior (declivous) part of the vertex more or less transversely aciculated. Eyes sparsely covered with minute hairs; shortest distance between the eyes to their width (head seen from above) as 5 : 3. A fine sharp ridge extends from the anterior ocellus to the antennal insertions. Antennæ: when the head is seen from the side the scape does not project above the vertex; funicle 1 about $1\frac{3}{4}$ times as long as wide; 2 a little shorter than 1; 3 and 4 small, transverse; 4 a little nearer in size to 3 than to 5, so that the club is more or less 6-segmented.

Thorax: Mesonotum evenly dull, as closely punctured as possible all over, the punctures moderately large but not sharp; their interstices appear somewhat raised, so that the sculpture could also be described as closely punctate-reticulate. Scutellum punctured all over like the mesonotum, but the sculpture generally closer. Postscutellar spine sharply pointed, but not narrow, about two-thirds as long as the scutellum (figs. 3 g, 4 j). Lateral areas of the propodeum bare except for a few hairs at the sides, costate, but the costæ, as is usual in the species-group, obliterated in the middle. Mesopleura more or less coarsely rugose-punctate, beneath the sharply defined and even ridge.

Abdomen: Tergite 1 fully $2\frac{1}{2}$ times as wide apically as its medial length (fig. 8 a); 3 nearly twice as wide as long, 5:3, predominately striated all over; 4 rugulose almost all over.

Length 1.6 mm. approx.

CAPE PROVINCE (Aliwal North), Dec., 1 ♀.

This species is largely characterized by the sculptured frons and the dull, even sculpture of the mesonotum.

11. *Hoplogryon pylus*, sp. n.

In general facies closely resembling *codrus*, and in spite of a marked sculptural difference, which could, however, be interpreted as one of degree, perhaps only a local form of that species. It differs as follows:—

♀.—The frons, instead of being conspicuously sculptured as in *codrus*, is predominately smooth and shining, with only very superficial and feeble indications of longitudinal rugulosity on its upper half. The mesonotum is a little less dull. The striations of tergite 3 are less marked, and laterally and medially the segment tends to become completely smooth.

CAPE PROVINCE (Cape Town, Milnerton), Feb., 1 ♀.

12. *Hoplogryon tityrus*, sp. n.

♂.—Black. Basal half of scape, radicle, mandibles, and legs bright honey-brown; the hind tibiae and all the tarsi are slightly infuscated. Abdominal tergite 1 is very nearly of same colour as the legs.

Head: Entire frons, apart from the more lateral of the genal striations, which extend upwards along the inner orbit to the mid-point of the eye, very smooth and shining. Posterior (declivous) part of the vertex, immediately behind the ocelli, smooth and shining. Temples with a greater or less indication of delicate aciculations. Eyes completely bare. Frons with a very distinct, fine, sharp ridge extending from the anterior ocellus to the antennal insertions. Antennae considerably longer than the body, very slender (fig. 12 g); funicle 2 distinctly longer than the scape; entire funicle conspicuously clothed with more or less upstanding, slightly curved, or more or less straight hairs, which are clearly longer than the segments are wide; in one example from Durban they are nearly twice as wide; segment 1 fully five times as long as wide.

Thorax: Mesonotum in greater part virtually smooth, shining, and unsculptured; in front (anterior third or quarter) the surface becomes finely rugulose; there is no trace of sculpture whatsoever on the posterior part of this sclerite; it is margined in front (except at its extreme anterior point) and antero-laterally, as well as postero-laterally, by a deep crenulate furrow. Scutellum entirely smooth and shining. Postscutellar spine sharp, narrow, fairly long, but not so long as the scutellum. Lateral areas of the propodeum evenly and thickly covered all over with whitish hairs. Lower convex part of mesopleura entirely smooth and shining; no trace of a ridge margining the depression below. Hind wing: (fig. 13 c).

Abdomen: Tergite 1 hardly $1\frac{1}{2}$ times as wide apically as its medial length; 3 very finely and closely striate-reticulate all over and somewhat dull on account of this close sculpture; in one of the two specimens from Van Reenen, the reticulate element of this tergite is not obvious, but the grooves are very shallow and not open throughout, so that they appear punctate.

Length 1.7 mm. approx.

NATAL (Van Reenen), Jan., 2 ♂♂; (Durban, Sydenham), L. Bevis, March, 2 ♂♂.

The sculpture of the mesonotum affords probably one of the best characters for the determination of the species. It is likely that the vestiture of the propodeum is peculiar to a species-group, although in the case of the limited material dealt with in this paper it is a valuable aid to the recognition of the species itself.

One male from Durban has the first abdominal tergite and the base of the second markedly honey-yellow; a good deal of variation in the degree of the pale coloration of these two tergites is to be expected.

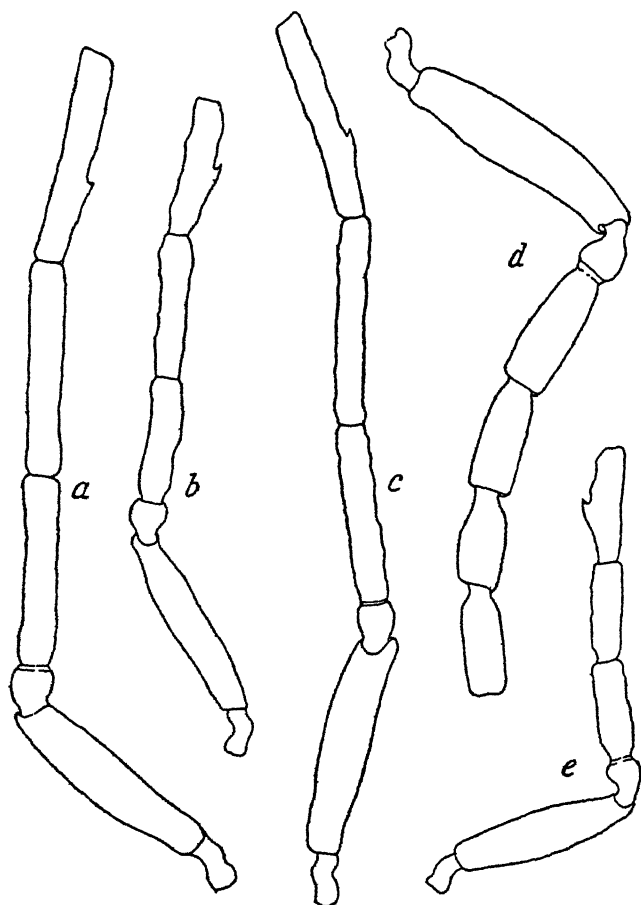
13. *Hoplogryon sperches*, sp. n.

♂.—Head (excluding mandibles and antennal scapes, both of which are yellowish) and abdomen entirely black. Entire thorax and legs honey-yellow.

Head (fig. 10 a): Frons with a fine ridge extending from the anterior ocellus to the antennal insertions; otherwise above the antennal insertions it is entirely, or at least predominately, smooth, with indications of

extremely feeble punctures and, nearer the orbit especially, with indications of very superficial striations; these latter striations represent the upward prolonging

Fig. 9.



Male basal antennal segments of: *a*, *Hoplogryon thoas*, sp. n.; *b*, *H. uranus*, sp. n.; *c*, *H. sperches*, sp. n.; *d*, *H. incertus*, sp. n.; *e*, *H. turesias*, sp. n.

of the normal genal striæ. Vertex between and behind the ocelli feebly sculptured, the sculpture consisting chiefly of feeble aciculations. Malar space about half

as long as the eye; the latter somewhat large and in two individuals with microscopic hairs. Interocular distance to scape as 2:2 (roughly). Antennæ long and slender (fig. 9c), a little longer than the body; funicle clothed throughout with rough, more or less upstanding hairs, which on the more apical segments are fully as long as the segments are wide (fig. 12a); segment 2 of the funicle fully as long as the scape and about six times as long as wide; 3 provided with a conspicuous wedge-shaped keel on basal half beneath. Clypeus: (fig. 14b).

Thorax: Mesonotum a little shining and somewhat coarsely punctured all over, virtually without striations posteriorly, except for the merest trace of them at the imaginary posterior origin of the parapsidal furrows. Scutellum punctured all over like the mesonotum. Postscutellar spine long and narrow, its total length fully equal to that of scutellum (fig. 4k). Lateral areas of the propodeum virtually glabrous and more or less strongly costate. Legs long and slender. Mesopleural ridge more or less sharply defined, the surface beneath, and contiguous with, it rugose-punctate.

Abdomen: Tergite 1 about $\frac{3}{4}$ as long as its apical width (fig. 8f); 3 not markedly transverse, 4:3 (roughly); this tergite is predominately punctate all over, the punctures as close as possible; towards the sides at the base there is a tendency for the sculpture to become decidedly punctate-reticulate; following segments more or less rugulose all over.

Length 1.7 mm. approx.

CAPE PROVINCE (Port St. John), Jan., 2 ♂♂; May, 1 ♂.

This species is very conspicuous on account of its coloration.

14. *Hoplogryon uranus*, sp. n.

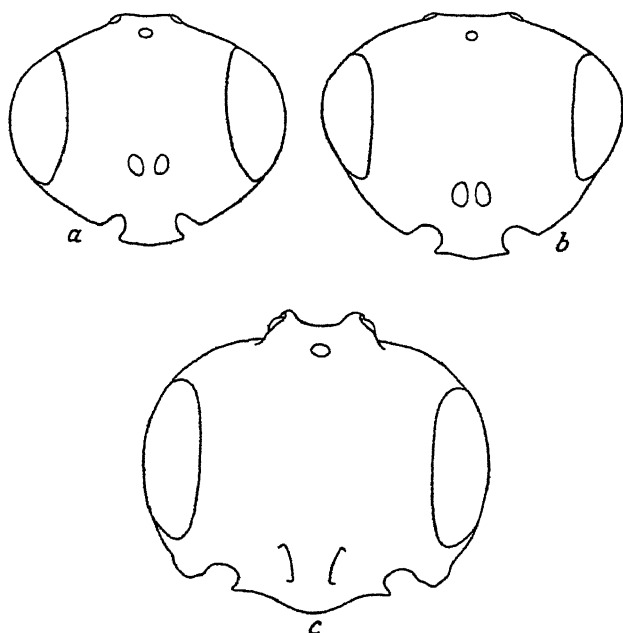
♂.—Very dark brownish black, with prosternum, tergite 1, and base of tergite 2 showing a marked reddish-brown tinge. Legs entirely reddish brown, paler or darker in individuals.

Apart from the colour-differences, this species may be compared with *Hoplogryon sperches*, sp. n., as follows:—

Head (fig. 10b): Except for the upward prolonging of the genal striations along the inner orbits to about the mid-point of the eye, the frons and the vertex between

and behind the ocelli are entirely smooth and shining; only at the temples is there some indication of aciculations. Ridge between the anterior ocellus and the antennal insertions hardly indicated. Eyes less large than in *sperches* and evidently quite bare. Interocular distance greater, compared with the length of the scape as 3:2. Antennæ a little shorter and with sparser vestiture

Fig. 10.



Male head of : *a*, *Hoplogryon sperches*, sp. n. ; *b*, *H. uramus*, sp. n. ;
c, *Macrogyron pluto*, sp. n.

than in *sperches* (figs. 9 *b*, 12 *e*), but funicular segments smoother and more shining; in one individual out of the three the segments are markedly smooth.

Thorax: Mesonotum very shining, more transverse than in *sperches* and allied species, exactly twice as wide as long; in one individual the posterior two-thirds of the mesonotum are markedly shining, with shallow ill-defined punctures, and with no trace of median striations at the base; in the other two examples the

sculpture is coarser, that is, the punctures are closer and posteriorly confused with irregular wrinkles which occupy the basal third of the sclerite. Parapsidal furrows represented by sharp narrow grooves which extend from the basal margin to about the middle, or a little beyond the middle, of the mesonotum. Scutellum entirely smooth on its posterior half, but anteriorly punctate, in two individuals the punctures somewhat coarse and confluent, in the third vague and shallow; every intermediate condition is to be expected. Post-scutellar spine a little stouter than in *sperches* (figs. 3 *h*, 4 *e*, *f*). Lateral areas of the propodeum glabrous and costate, the costæ more or less obliterated medially. Mesopleural ridge sharply defined, the surface beneath it dull and rugose.

Abdomen (fig. 11 *a*): Tergite 1 more transverse than in *sperches*, fully $2\frac{1}{2}$ times as wide apically as its medial length; tergite 3 strongly transverse, 9:5, strongly striated over its basal half; beyond the basal half the striations break up into a broken sculpture of vague reticulations and fine rugulosities. The general sculpture of tergite 3 is much less strong than in *sperches*. Tergite 4 with a band of rugulose sculpture.

Length 1.9 mm. approx.

CAPE PROVINCE (Somerset East), Oct., 2 ♂♂, Dec., 1 ♂.

It is the male taken in December which shows the reduced sculpturation. The species is largely characterized by the comparative shininess of the mesonotum. The funicular vestiture and more transverse shape of tergite 3 distinguish it from the following species.

15. *Hoplogryon thoas*, sp. n.

A more slenderly built species than *uranus*, sp. n., with which it may be compared as follows:—

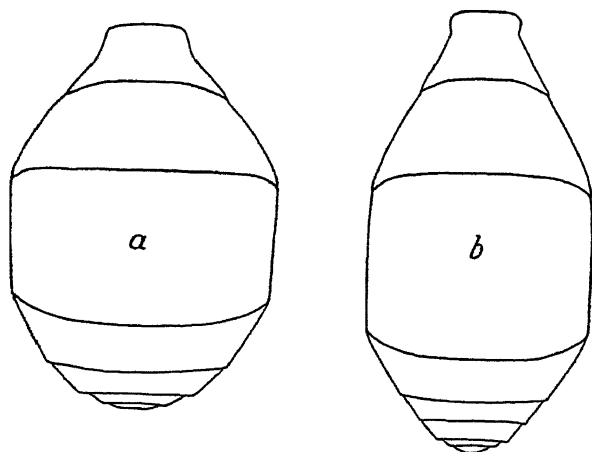
♂.—More or less black, with tergite 1 not at all reddish, except at extreme base. Sides of thorax markedly reddish.

Head: A sharp and well-marked ridge extends from the anterior ocellus to the antennal insertions. Frons somewhat depressed on either side of the central ridge, clothed rather conspicuously with short adpressed hairs; lower half of frons smooth and shining; upper half minutely punctulate. Posterior (declivous) part of the

vertex minutely sculptured and with traces of aciculations towards the temples. Eyes thickly clothed with extremely short hairs. Antennæ considerably longer than the body (figs. 9 *a*, 12 *c*), the hairs of the funicle denser, less rough, and shorter than in *uranus* and *sperches*, the funicular segments are also slightly thicker than in either of these two species.

Thorax: Mesonotum less transverse than in *uranus*, about 10:7, a little less shining and more decidedly punctured. No trace of striations at middle of base. No parapsidal furrows, though their imaginary course

Fig. 11.



Male abdomen of: *a*, *Hoplogryon uranus*, sp. n.;
b, *H. thoas*, sp. n.

is indicated posteriorly by one or two fine raised lines. Scutellum more heavily and decidedly punctured than in *uranus*. Postscutellar spine longer than in *uranus* and more narrowed (figs. 3 *l*, 4 *m*); it is hardly different from that of *sperches*. Hind wing: (fig. 15 *a*). Lateral areas of the propodeum 4- instead of 3-sided, owing to the two carinæ being very abruptly angled where they turn forwards to meet the mid-posterior point of the post-scutellum; the lateral areas are otherwise sculptured as in *uranus*, but are slightly hairy towards the sides. Mesopleural ridge more or less sharply defined, though

becoming somewhat indistinct posteriorly; surface beneath it as in *uranus*.

Abdomen (fig. 11 b): more elongate than in *uranus*; tergite 3 less transverse than in *uranus*, 11:9; this tergite is predominately punctate; only towards the sides does the sculpture become punctate-reticulate; on the disc of the segment the surface is very smooth and flat between the punctures; tergite 4 punctured in the middle and with fine rugulose sculpture towards the sides.

Length 2.2 mm.

NATAL (Van Reenen), Jan., 1 ♂.

The species is characterized chiefly by the shortness of the hairs of the funicle as compared with their usual length within the species-group, and also by the shape of tergite 3.

16. *Hoplogryon fons*, sp. n.

A species closely related to *thoas* and *uranus*, spp. n.

♂.—Black, but not deep black, with the sides of the thorax somewhat reddish. Legs (excluding tibiae and tarsi, which are darker) dirty greenish yellow.

Head: Frons normally convex, not flattened on either side of the central ridge as in *thoas*. Sculpture of the head similar to that of *thoas*, but a little stronger. Eyes evidently with microscopic hairs, but these are much less in evidence than in *thoas*. Antennæ considerably longer than the body, more slender than in *thoas*; on the more apical segments of the funicle, the hairs are fully as long as the segments are wide.

Thorax: Mesonotum dull, strongly and as closely punctured as possible all over, the interstices not strongly shining as in the two preceding species. There is no trace of parapsidal furrows, nor of fine lines indicating their imaginary course. Scutellum punctured all over, the puncturation similar to that of the mesonotum. Postscutellar spine similar to that of *thoas* (fig. 3 f). Lateral areas of the propodeum more or less costate, bare. Mesopleural ridge sharply defined, the surface beneath it as in *uranus*.

Abdomen: Tergite 1 nearly $2\frac{1}{2}$ times as wide apically as its medial length; tergite 3 strongly transverse, 8:5, strongly sculptured all over; the surface is very irregularly striate-punctate medially, becoming reticulate-

punctate or merely punctate towards the sides ; tergite 4 more or less rugulose all over.

Length 2 mm. approx.

CAPE PROVINCE (Port St. John), Dec., 1 ♂.

This species could be confused only with *thoas*, from which it is distinguished by longer funicular vestiture (not a very obvious character), less shining mesonotum, and more transverse second tergite.

17. *Hoplogryon tiresias*, sp. n.

A species similar in build to *H. uranus*, sp. n., with which it may be compared as follows :—

♂.—Distribution of lighter and darker areas much as in *uranus*, but colour on the whole darker.

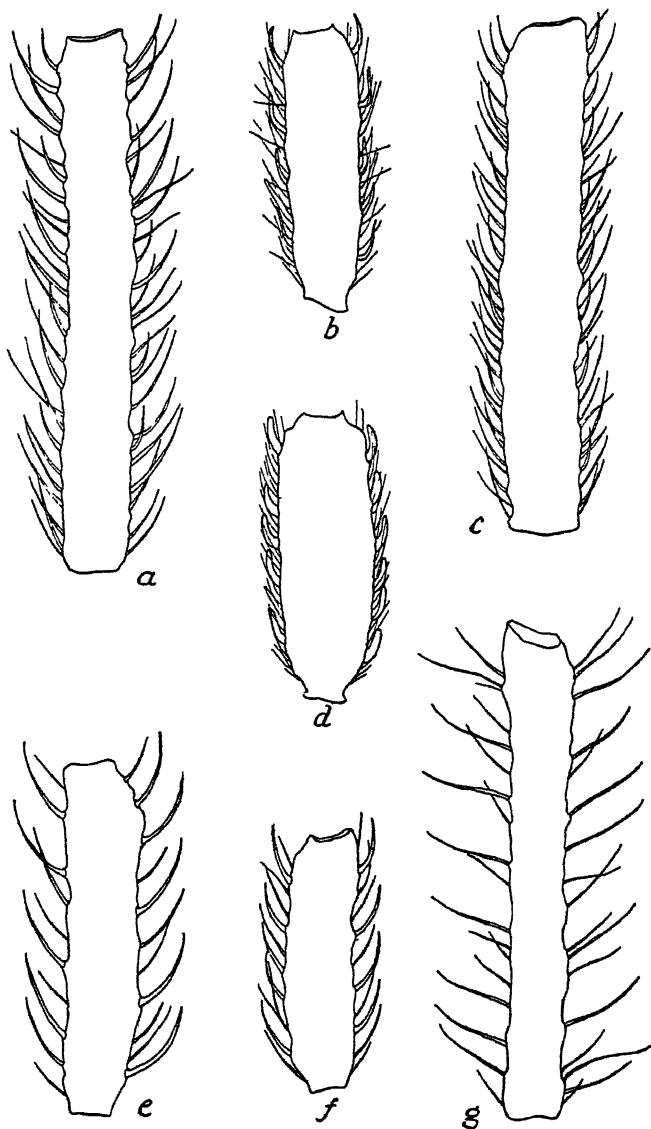
Head : Lower half of the frons smooth and shining ; upper half shining, but minutely punctulate in two of the individuals ; in the third the genal striations continue upwards, along the inner orbit, as a broad band of sculpture to the vertex ; this striate sculpture breaks up in proportion as it approaches the vertex. Vertex between and to the sides of the posterior ocelli quite dull and very finely rugose. Ridge between the anterior ocellus and the antennal insertions more or less sharply indicated. So far the sculpture of the head is very similar to that of *sperches*, but that species has much larger eyes among other characters. Eyes clothed with excessively minute, by no means readily visible, hairs. Antennæ more or less similar in length and vestiture to those of *uranus* (figs. 9 e, 12 f).

Thorax : Mesonotum, at least on anterior two-thirds, markedly dull ; the surface is very finely, superficially, and indeterminately punctate-reticulate, almost finely rugose. Parapsidal furrows showing as more or less shallow grooves on posterior half of mesonotum. Scutellum finely, but more or less confusedly, punctate on its greater basal part, but the sculpture duller than in *uranus*. Postscutellar spine shorter, less narrow, and more triangularly dilated at base than in *uranus*. Mesopleura as in *uranus*.

Lateral propodeal areas with some fine hairs and with its longitudinal sulci not at all, or hardly, obliterated medially ; lateral teeth somewhat short and blunt.

Abdomen : Tergite 3 more shining than in *uranus*,

Fig. 12.



Male fourth funicular segment ($\times 220$) of: *a*, *Hoplogryon sperches*, sp. n.; *b*, *H. sejus*, sp. n.; *c*, *H. thoas*, sp. n.; *d*, *H. incertus*, sp. n.; *e*, *H. uranus*, sp. n.; *f*, *H. tiresias*, sp. n.; *g*, *H. tityrus*, sp. n.

its striations finer and more even; general sculpture of this tergite much less coarse.

Length 1.6 mm. approx.

CAPE PROVINCE (Mossel Bay), June, Sept., 2 ♂♂;
E. CAPE PROVINCE (Katberg, 4000 ft.), Oct., 1 ♂.

18. *Hoplogryon carus*, sp. n.

♂.—Colour: Blackish brown; the pronotum especially, and the metapleura, markedly reddish brown.

Scape reddish yellow, darkened towards the apex. Legs, tergite 1 and base of 2 conspicuously reddish yellow; the legs are brighter and more yellowish than the pale parts of the abdomen.

Head, seen along a line perpendicular to a line between the posterior ocelli, almost exactly twice as wide as long, and, except for the normal genal striations which extend a little above the antennal insertions and a few of which extend upwards along the inner orbit to a level with the top of the eye, entirely and very conspicuously smooth and shining everywhere; the merest trace of transverse striations is to be seen on each side of the posterior ocelli. An extremely fine (above, more or less obliterated) line extends from the antennal insertions to the anterior ocellus. Eyes bare, the shortest distance between them about twice as great as their width (as seen from above), about 13:6. Antennæ very long and slender, fully $1\frac{1}{2}$ times as long as the body; funicle 2 considerably longer than the scape; 3 a little shorter than 2, with a well-marked keel extending along its basal half; the entire funicle is clothed with semi-erect hairs, which are clearly shorter than the width of the stouter, more basal segments, but fully as long as, or even longer than, the more apical segments; most of these hairs are slightly curved.

Thorax: Mesonotum shining, closely and shallowly punctured, the punctures fairly small, oblique, and, for the most part, ill defined; anteriorly (and this is the usual condition) the punctures are confused, so that the surface is more or less rugulose; posteriorly they become sparser and much more sharply defined. Scutellum in greater part smooth and shining; on its mid-basal part there is a crowding together of punctures, and around this area of dense puncturation there are scattered

punctures. Postscutellum, apart from the lateral basal expansions of the medial process, deeply hollowed out (this condition showing as a channel on each side) and not at all markedly costate as is usual in the genus; the costæ are reduced to a row of inconspicuous crenulations along the centre of the channel; the lateral basal expansions of the medial process are flattened and polished, and extend over about one-third of the half-width of the postscutellum; seen from the side, the central projection stands up almost at right angles to the long axis of the thorax; it is about $\frac{3}{4}$ the length of the scutellum, fairly thick and *forked* at its apex; the prongs are short and diverge from each other at an angle of about 120° , as seen from above. Lateral areas of the propodeum covered with sparse hairs, which do not obscure the sculpture; this consists of vague feeble rugosities with indications of more regular costæ along the margins. Mesopleura below the sharply-defined ridge more or less rugose-punctate.

Abdomen nearly twice as long as wide, 13:7, strongly narrowed basally; tergite 1 but little longer medially than its apical width, very unevenly striated, the ridges sparse and very much confluent, so that a reticulate condition is suggested; the sculpture of this tergite is somewhat characteristic, but, as I am dealing with a single individual, it is impossible to say to what extent it is specific; tergite 3 strongly transverse, 14:9, entirely smooth and shining; this and the following tergites are clothed only with rather long, very sparse hairs.

Length 2.3 mm. approx.

NATAL (Kloof), *L. Bevis*, March, 1 ♂.

With regard to the description of mesonotal and scutellar sculpture, it is important to emphasize that only one individual has been described. Full allowance must be made for sculptural variation; this applies especially to the scutellum, where the somewhat peculiar arrangement of punctures is hardly likely to appear in every individual of the species.

Hoplogryon carus, sp. n., is at once characterized by the forked spine of the postscutellum, if this feature has only specific value. More material might show it to be a structure peculiar to a species-group, though its actual form is probably specific.

19. *Hoplogryon amphiaraus*, sp. n.

♀.—Black. Radicle of the antennæ, scape, pedicel, mandibles, legs entirely, tergite 1, and basal half of tergite 2 honey-yellow. The honey-yellow pedicel contrasts sharply with the brownish-black funicle.

Head, seen along a line perpendicular to a line drawn between the posterior ocelli, not quite twice as wide as long, 15:8 (fig. 1 c). Entire frons evenly convex, entirely smooth and shining; there is no trace of a ridge between the anterior ocellus and the antennal insertions. Vertex everywhere likewise smooth and shining. Eyes markedly large, apparently bare, the shortest distance between them to their width (the head being viewed from above) as 4:3. Antennæ long and powerful (fig. 2 c); radicle unusually long, fully one-third the length of the scape; scape, when the head is seen from the side, projecting above the vertex by about two-fifths of its own length; funicle 1 hardly twice as long as wide; 2 distinctly longer than 1, fully twice as long as wide; 3 very slightly longer than wide; 4 as long as wide, markedly thicker than 1 and 2; the whole funicle is gradually thickened from base to apex, so that there is no clearly differentiated club.

Thorax: Mesonotum conspicuously smooth and shining all over, covered sparsely with rather long, adpressed hairs; some of these hairs arise from a microscopic puncture. Scutellum smooth and shining. Postscutellar spine short and somewhat blunt. Lateral areas of the propodeum bare, striate along the posterior half; lateral teeth absent. No trace of a mesopleural ridge, the surface beneath the depression in far greater part smooth and shining. Hind wing: (fig. 13 a).

Abdomen: Tergite 1 hardly twice as wide apically as long medially; 3 transverse, with sharp, strong, well-defined costæ-like striations along its posterior margin; the longest of these are not much more than one-third the length of tergite 2; 3 is otherwise entirely smooth and shining.

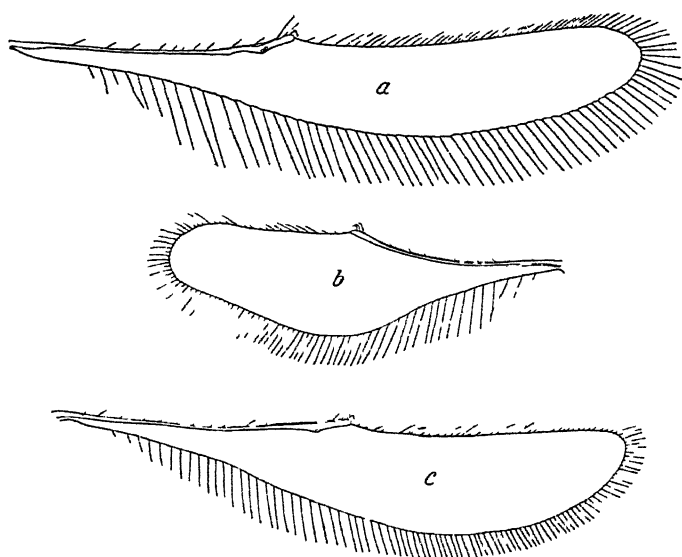
Length 1.1 mm. approx.

CAPE PROVINCE (Port St. John), July, 1 ♀.

This species is largely characterized by its smooth shining mesonotum as well as by the form of the antennæ with their comparatively long radicle.

The shape of the hind wing and the general smoothness of the head and of the mesonotum point to a relationship with *tityrus*, of which, unfortunately, only the male is known.

Fig. 13.



Hind wing of : a, *Hoplogryon amphiarus*, sp. n., ♀ ;
b, *H. laius*, sp. n., ♀ ; c, *H. tityrus*, sp. n., ♂.

20. *Hoplogryon paris*, sp. n.

A small species, 1.1 mm. approx., in the form and sculpture of the abdomen resembling *H. amphiarus*, sp. n., from which, however, it differs in important details; it is much more typical of *Hoplogryon* in a narrow sense than that species.

♀.—Very dark brownish black. Legs reddish brown. Tergite 1 and the base of 2 markedly reddish.

Head: Frons evenly convex, virtually smooth and shining, but with indications of excessively minute punctures. Posterior (declivous) part of the vertex likewise smooth and shining. Antennæ fairly long and powerful; radicle very short and inconspicuous, many times shorter than the scape—this character alone readily separates it from *amphiarus*; scape, when the head is

seen from the side, clearly projecting above the level of the vertex; funicle 2 about $1\frac{1}{4}$ times as long as wide, shorter than 1; 3 and 4 small, bead-like. Eyes much less large than in *amphiaraus*, covered with minute hairs.

Thorax: Mesonotum very finely rugose. Scutellum with a varying degree of sculpturation similar to that of the mesonotum. Postscutellar spine short and sharp. Mesopleural ridge sharply defined, margined on both sides by a row of costæ-like punctures. Lateral areas of the propodeum sparsely clothed with hairs.

Abdomen not much longer than wide, 22:15; tergite 1 fully twice as wide apically as its medial length; sculpture of abdomen as described for *amphiaraus*.

Length 1.1 mm. approx.

CAPE PROVINCE (Somerset East), Sept., Oct., Jan., 3 ♀♀.

21. *Hoplogryon laius*, sp. n.

♂♀.—Black. Legs brown or more usually nearly black.

♀.—*Head* very slightly narrower than the thorax across the tegulæ, 32:33. Frons almost everywhere entirely smooth and shining, or at the most with indications of feeble punctures just in front of the posterior ocelli. The genal striæ extend hardly above the lowest point of the eye, so that the surface along the inner orbit is entirely smooth. Eyes covered with scattered, extremely minute hairs; greatest length of the eye hardly longer than the malar space. Posterior (declivous) part of the vertex with extremely fine, aciculate rugulosities, sometimes almost smooth. Antennæ: funicle 1 and 2 subequal in length, equal in thickness; 1 fully twice as long as wide; 2 a little shorter than 1; 3 and 4 small, bead-like; club very clearly 6-segmented.

Thorax: Mesonotum almost exactly twice as wide as long (this measurement excludes the tegulæ), slightly shining, its sculpture indeterminate, very feeble, and superficial, and showing a feeble falling off in intensity from anterior to posterior margin; this sculpture could be described as very finely alutaceous, with indications of microscopic punctures and microscopic raised rugulosities; sometimes it approaches a very fine, granulate condition. Scutellum more shining and more feebly

sculptured than the mesonotum, sometimes almost smooth. Postscutellar spine moderately long, sharp, more or less triangular, and about half the length of the scutellum. Surface below and anterior to the sharply defined mesopleural ridge conspicuously costate all over. Lateral triangular areas of the propodeum bare, costate, but the costæ obliterated medially. Hind wing: (fig. 13 b).

Abdomen: Tergite 1 strongly transverse, fully twice as wide apically as its medial length; 3 nearly twice as wide as long, covered everywhere with an extremely fine, very superficial scaly-reticulate sculpture; there is no trace whatever of striations at the base of the segment.

Length 1.15 mm. approx.

♂.—Differs from the ♀ as follows:—

Antennæ nearly $1\frac{1}{2}$ times as long as the body, very slender, the funicle clothed conspicuously with nearly erect, slightly curved hairs, which are very slightly longer than the width of the segments themselves. Wings vestigial, seen from the side extending to as far as the base of the postscutellar spine.

CAPE PROVINCE (Somerset East), Sept., Oct., Dec., 7 ♀♀; Jan., 3 ♂♂.

This small dark insect is readily recognized by the sculpture of the third tergite.

22. *Hoplogryon cyclops*, sp. n.

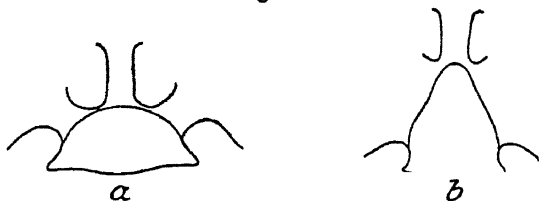
♂♀.—Black. Mandibles reddish brown. Legs much the same colour as the mandibles, except femora and sometimes the tibiæ which are darker.

♀.—*Head*: Upper part of the frons very shining, with scattered, vaguely impressed punctures of variable size; sometimes these punctures are virtually absent. At least one or two of the genal striations sometimes extend up along the inner orbit of the eye, almost to a level with the anterior ocellus. Vertex behind the ocelli markedly shining, often nearly unsculptured, but usually with some delicate striations (aciculations). Eyes with very short, but readily visible hairs. Antennæ: funicle 1 nearly twice as long as its apical width; 2 about three-quarters of the length of 1; 3 and 4 bead-like; club

very distinctly 6-segmented. Malar space about half as long as the eye.

Thorax: Mesonotum over its greater anterior part clearly punctured, the punctures strong, but on the whole not sharp; they are as close together as possible, and the spaces between them are strongly shining; on the posterior third of the mesonotum the punctures give way to strong, fairly even striations, which are often much longer along the imaginary course of the parapsidal furrows. Scutellum with a smooth shining space in the middle, but elsewhere with strong close punctures. Scutellar spine sharp, but triangularly dilated, about half as long as the scutellum (fig. 4 c, d). Lateral areas of the propodeum more or less punctate-reticulate. Legs slender, typical for the genus. Mesopleural ridge more or less sharply defined, the surface beneath it reticulate-punctate.

Fig. 14.



Male clypeus of: a, *Hoplogryon cyclops*, sp. n.;
b, *H. sperches*, sp. n.

Abdomen: Tergite 1 with its apical width not much greater than its medial length (fig. 8 d, e); 2 evenly striated all over; 3 at the most with very faint, superficial striations, but the more often entirely smooth and unsculptured, except for a tiny patch of scaly-reticulate (almost rugulose) sculpture close to each apical lateral angle; following tergites in greater part smooth, with only scattered, very small, vague punctures, but towards the sides there is some sculpture similar to that which occurs on tergite 3.

Length 1.3–2.2 mm. The smaller measurements seem to be exceptional.

♂.—*Head*: In general distribution of sculpture similar to the ♀. *Antennæ*: funicle 5 and 6 hardly less than

twice as long as wide; entire funicle clothed only with excessively short, adpressed hairs. Clypeus: (fig. 14 a). Hind wing: (fig. 15 b).

Abdomen: Tergite 3 nearly always entirely smooth and shining, except for the tiny patch of sculpture as described for the ♀.

Average length 2.2 mm., though examples of 1.2 mm. occur; such small individuals have the punctures of the mesonotum less close, smaller; the mesonotum is hence more shining than in typical examples; the posterior striations evidently remain constant in strength, but the scutellum is smooth and shining all over.

CAPE PROVINCE (Somerset East), Oct.–Jan., 27 ♂♂, 5 ♀♀; (Mossel Bay), Feb., Mar., May, Aug., 13 ♂♂, 1 ♀; (Queenstown), Feb., 1 ♂; (Port St. John), Sept., 1 ♀; (Ceres), April, 1 ♀; (Aliwal North), Dec.–Jan., 2 ♀♀; E. CAPE PROVINCE (Katberg), Oct., 1 ♂; NATAL (Van Reenen), Oct.–Nov., 3 ♂♂, 1 ♀; ORANGE FREE STATE (Harrismith), Feb.–Mar., 9 ♂♂.

The species is evidently characterized by the shining punctate surface of the anterior part of the mesonotum and by the presence of well-marked and conspicuous striations on its posterior part, and also by the smoothness of tergite 3.

23. *Hoplogryon sejus*, sp. n.

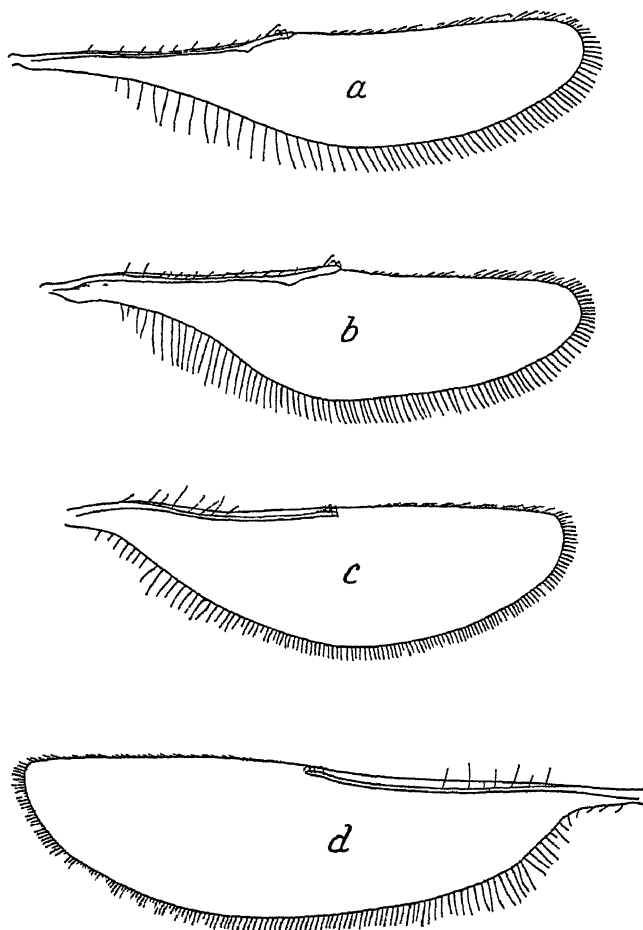
♂.—Black. Mandibles, scape of antennæ (more or less), legs, except coxæ which tend to be darker, tergites 1 and 2 and base of 3 yellowish red.

Head slightly more transverse than in *cyclops*. Sculpture of the head not essentially different from that of *cyclops*, except that the fine, somewhat superficial striations which extend upwards along the inner orbit converge sharply inwards at the vertex and meet the ocelli. Vertex behind the ocelli and the temples entirely smooth and shining. Antennæ a little less stout than in *cyclops*, and with the hairs of the funicle slightly more upstanding (fig. 12 b); funicular segments 4 and 5 fully three times as long as wide; 7–9 fully four times as long as wide. Eyes quite bare.

Thorax: Mesonotum in greater part smooth, very shining with small ill-defined punctures which are crowded on the extreme anterior margin of the sclerite,

but which over its greater part are separated by more than many times their diameter. Course of the parapsidal furrows indicated by two or three fine raised lines; along the posterior margin of the mesonotum more of

Fig. 15.



Male hind wing of: *a*, *Hoplogryon thoas*, sp. n.; *b*, *H. cyclops*, sp. n.; *c*, *Macrogryon echion*, sp. n.; *d*, *M. phito*, sp. n.

these lines occur, so that there is an approach to the usual striate condition of this part as is seen in *cyclops*. Scutellum almost everywhere entirely smooth and shining;

only towards the sides is there some fine sculpturation. Postscutellar spine less sharp than in *cyclops*, forming more or less an equilateral triangle. Mesopleural ridge more or less sharply defined, the surface beneath it somewhat strongly rugose-punctate.

Abdomen wider than in *cyclops*, and hence appearing more petiolate; tergite 1: (fig. 8 i); tergite 3 striate only at the extreme base, the striæ so short as to appear like a transverse row of oval punctures; this tergite is otherwise entirely smooth; in the one individual present, there are no small lateral apical patches of sculpture on tergite 3 as appear in *cyclops*; tergites 4 and 5 shining, with a few scattered punctures and inconspicuous lateral patches of sculpture.

Length 2.1 mm. approx.

CAPE PROVINCE (Port St. John), Sept., 1 ♂.

Evidently this species is chiefly characterized by the smoothness of the mesonotum, and perhaps by the colour of the first two tergites, together with the extremely short striations of tergite 3. This last character alone will at once separate it from the preceding species.

24. *Hoplogryon* (*Teleas* ?) *incertus*, sp. n.

♂♀.—Black, but not intensely black. Antennæ brownish. Mandibles obscure to bright reddish brown. Legs (except femora, which are darker) much the same colour as the mandibles, at least on the tarsi.

♀.—*Head*: Temples rather strongly produced backwards behind the eyes, so that these do not occupy nearly the whole lateral surface of the head. Frons above the antennal insertions entirely smooth and shining, but towards the anterior ocellus the surface becomes finely striate-punctate; in smallish examples the striate element tends to fade out, leaving small, vaguely impressed punctures. Vertex behind the ocelli shining and with vague rugulosity, which show a tendency to form transverse but quite superficial striations. Eyes clothed with scattered, extremely short hairs. Length of the eye to malar space as 5 : 3 (approx.). Antennæ (fig. 6 c): funicle 1 about $1\frac{3}{4}$ times as long as wide; 2 three-fourths as long as 1; 3 and 4 small, transverse; club clearly 6-segmented. Cheeks regularly striated.

Thorax: Middle of the mesonotum reticulated, the reticulations delicate and often broken; the largest of them could just about contain an ocellus; anteriorly these reticulations break up to form an irregular sculpture, in which small transverse rugulosity predominate; posteriorly they show a tendency to form widely separated raised lines, which are very irregularly arranged. Scutellum brokenly reticulated all over. Postscutellar process produced apically into a triangular rather than spinose projection (fig. 4 a, b). Lateral areas of the propodeum at least rugulose, often with some broken reticulations. Mesopleural ridge more or less sharply defined, the surface beneath it reticulate-punctate. Legs short, like those of a true *Teleas*; hind femora much swollen (fig. 16), in some aspects about 3 times as long as wide; hind tarsi shorter than their tibiae.

Fig. 16.

*Hoplogryon incertus*, sp. n., ♀, hind femur.

Abdomen: Tergite 1 about $1\frac{1}{2}$ times as wide apically as its medial length, often with distinct trace of a horn at base; 3 with a wide patch of striated sculpture covering roughly its medial basal half; the length of the striae is variable, the grooves between them, especially between the more lateral ones, often contain transverse rugulosity; the lateral striae also show a marked tendency to curve inwards at about their middle; tergite 3 is also very strongly transverse, about 5:3; following segments more or less smooth, with only a few scattered punctures.

Length 1.5–2 mm.

♂.—*Head*: Sometimes the strong genal ridges extend up higher on the frons than in the ♀, almost covering the smooth area above the antennal insertions, and the more lateral of them reaching the level of the anterior ocellus. Unlike the ♀, the frons, where it is contiguous

with the anterior ocellus, is often extensively smooth and almost impunctate. The sculpture of the vertex is always vague, delicate, and indeterminate, and much like that of the ♀. Eyes: hairs even less obvious than in the ♀. Antennæ nearly as long as the body (figs. 9 *d*, 12 *d*); funicle clothed with excessively short, adpressed hairs; segments 4 and 5 about $1\frac{1}{2}$ to $1\frac{3}{4}$ times as long as wide; 9 and 10 fully, or even a little more than, twice as long as wide; in small examples the segments are all a little shorter.

Thorax: Course of the parapsidal furrows sometimes indicated by one or two fine raised lines (forward extensions of the normal posterior striations), which, when there are two, lie close to each other; posterior striations are often more clearly defined than in the ♀. Legs with the femora less thickened than in the ♀. Tergite 1: (fig. 8 *g, h*).

Length 1.4–2.2 mm.

CAPE PROVINCE (Somerset East), Oct.–Jan., 7 ♂♂; (Aliwal North), Dec.–Jan., 4 ♀♀, 2 ♂♂; (Mossel Bay), Dec., Feb.–Mar., 1 ♀, 6 ♂♂; (Port St. John), April, 1 ♂; E. CAPE PROVINCE (Katberg), Oct., 1 ♂; NATAL (Van Reenen), Dec., 1 ♀; ORANGE FREE STATE (Harrismith), Feb.–Mar., 2 ♂♂.

The swollen femora of the hind legs are a less striking feature of the male than of the female, and in fact are but little thicker than the hind femora of many males of *Hoplogryon*, in which genus I prefer to place the species provisionally.

MACROGRYON, gen. nov.

Species of relatively very large size, not less than 4.8 mm. in length.

Head: Vertex not sharply angled across the posterior ocelli, so that its posterior (declivous) part does not fall at all perpendicularly away from these. Clypeus, seen from beneath, deeply hollowed out (channelled) across its whole apical width, so that it appears to have a double apical margin; further, the clypeus is very wide, fully as wide as the scape, feebly to fairly deeply bisinuate and with acutely produced lateral angles; distance between its mid-apical point and the antennal insertion, *i. e.*, the lowest point of the antennal socket when the head

is seen from the side, very much less than the width of the clypeus; in the one available ♀ this comparison of lengths is not possible, for the antennal prominence is situated at the extreme apex of the clypeus, so that, seen from the side, the lowest point of the antennal socket and the apical margin of the clypeus coincide. Eyes clothed sparsely with fairly long hairs, large, fully 4 times as long as the very short malar space; in African species of *Hoplogryon* the eyes are at most $2\frac{1}{2}$ times as long as the malar space. Antennæ 12-segmented in both sexes; funicle of the ♂ without conspicuous upstanding hairs, about as long as the body; segment 3 with only a very feeble, inconspicuous keel on basal half beneath; funicle 1 in the ♀ very long, fully twice as long as the greatest length of 2.

Thorax: Mesonotum very coarsely sculptured and with a conspicuous longitudinal element in the sculpture. Scutellum coarsely sculptured all over, at each apical lateral corner, with a well-developed tooth (fig. 17). Postscutellum with a large, medial, spinose projection; fore wings typical of the subfamily. Mesopleural depression not margined by a ridge. Costa of hind wings at its apex not touching the edge of the wing. Lateral propodeal teeth short or blunt.

Abdomen: Tergite 1 not at all transverse, the entire abdomen very coarsely sculptured.

Type of the genus, the following species:—

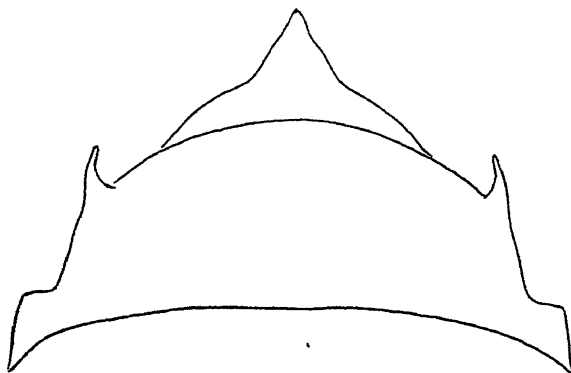
Macrogyron pluto, sp. n.

♂.—Colour: Black, with the mandibles and extremities of the segments of the legs reddish.

Head fairly thickly clothed with long pale hairs; the longest of these hairs, *i. e.*, the more erect ones on the vertex, are fully half as long as the scape. When the head is seen along a line perpendicular to a point equidistant from the posterior ocelli and the occipital margin it is fully twice as wide as its greatest length, 57:28 (figs. 1 e, 10 c). Frons somewhat flattened, its strong ridges wide apart, and, where they are widest, the space between them is often about as wide as the anterior ocellus; immediately above the antennal insertion the ridges fade out, leaving a subtriangular, more or less

smooth area; the ridges extend almost unbrokenly up to the anterior ocellus; the spaces between them are sometimes nearly smooth, sometimes with feeble interconnecting rugæ. Ocelli connected on their inner side by a more or less clearly defined, much raised, irregular, semicircular ridge; the ocelli give the impression of being embedded in a plexus of prominent, much raised rugosities; further, they are situated well in front of the crest of the vertex. Vertex behind the ocelli very coarsely reticulated to striate-reticulated. Eyes clothed sparsely with long pale hairs. Antennæ: seen from the side, the scape does not reach the anterior ocellus

Fig. 17.

*Macrogyron phuto*, sp. n., ♂, scutellum and postscutellum.

by about one-third of its own length; scape to funicle 1 as 4:3; funicle thick, fully as long as the body, entirely without outstanding hairs, except at the apex of the segments where very short, inconspicuous hairs project as a feeble fringe; the general clothing of the funicle consists of excessively minute adpressed hairs, so that it appears to be virtually glabrous; segment 1 fully three times as long as wide; 2 two-thirds as long as 1; following segments gradually increasing in length, 9 being about as long as 1.

Thorax above, and to some extent at the sides, clothed with long, more or less erect, brownish hairs,

which, on the whole, are fully half as long as the scape, especially those on the scutellum. Mesonotum very coarsely striate-reticulate, the striate element always predominating and sometimes very well marked. Parapsidal furrows often indicated as a broad, more or less smooth channel between two ridges on posterior half. Scutellum merely coarsely reticulated, at most with indications of a central ridge. Teeth of the scutellum about half as long as the postscutellar projection, curved slightly inwards and downwards. Postscutellar projection about half as long as the scutellum (fig. 3 *a, b, c*); seen from above, it appears as a very acutely pointed, triangular process (fig. 17); from the side it is thick, but variable in shape within narrow limits, and it does not project above the level of the disc of the scutellum; it is either strongly reticulated along each side and has then a well-marked central carina or else it tends to be reticulate all over. Each lateral area of the propodeum divided by 4 (sometimes the innermost one is obliterated) longitudinal carinæ into five areas; the three (or two) inner areas are entirely glabrous and smooth; the outer two and the actual sides of the propodeum are densely clothed with pale brownish pubescence; sometimes the pubescence of the fourth area encroaches on to the third; the glabrous areas themselves sometimes show traces of transverse rugæ. Metapleura strongly pubescent and with longer hairs mixed above. Mesopleura with the oblique depression glabrous and transversely ribbed; the lower convex surface hairy and reticulate-rugose. Legs with the femora and the tibiæ—especially the hind tibiæ—clothed, in addition to the normal pubescence, with long outstanding hairs similar to those of the thorax, but paler. Hind wing: (fig. 15 *d*).

Abdomen nearly twice as long as wide, 19 : 10; tergite 1 about as long as its apical width; 3 coarsely striate-reticulate with indications of punctures medially where the surface tends to become quite smooth; this tergite is about twice as wide as long, 23 : 12; 2 and 3 at the sides, rest more or less all over, clothed with long hairs; 4, 5, and 6 coarsely reticulate-punctate.

Length 4.9 mm. approx.

E. CAPE PROVINCE (Katberg), 4000 ft., Dec.-Feb., 25 ♂♂; TRANSKEI (Umtata), Feb.-Mar., 1 ♂; CAPE PROVINCE (Queenstown), 3500 ft., Feb.-Mar., 1 ♂.

Macrogryon cælebs, sp. n.

♀.—This species, doubtfully distinct from *Macrogryon pluto*, sp. n., may be compared with it as follows:—

Head (fig. 7 f): The frontal striations break up into fairly even reticulations just above the middle of the frons. The ocelli are not situated on a plexus of prominent raised rugosities, and there is no clear indication of a semicircular ridge connecting them inwardly as in *pluto*. The setting of the ocelli is thus inconspicuous by comparison with that of the ♂ of *pluto*. *Antennæ* (fig. 2 d): scape, when the head is seen from the side, reaching to the level of the top of the eye; pedicel

Fig. 18.



Macrogryon cælebs, sp. n., ♀, sixth abdominal tergite.

hardly one-third the length of funicle 1; funicle 1 extraordinarily elongated, fully $2\frac{1}{2}$ times the greatest length of 2; 2 almost square in outline, when measured along its shortest side; 3 and 4 transverse, with the ventral side twice as long as the dorsal; club not clearly differentiated, but little thicker than funicle 2. Six or so long hairs fringe the apical margin of the clypeus, and similar hairs occur on the mandibles beneath, but the insect lacks the characteristic hairiness of *pluto*.

Abdomen almost exactly twice as long as wide; 3 strongly transverse, 27:16, with a very strong, predominating, striate element over its greater medial part; towards the sides the tergite is more or less coarsely punctate; on each side of this tergite, near the apical margin and running parallel to it, is a fringe of excessively short hairs; this fringe marks the apical limit of a hairy patch on each side of the segment; further, it margins

an extremely narrow band of finely rugulose sculpture; this specialized modification is feebly indicated in the ♂ of *pluto* and of the following species, and corresponds possibly to the patch of sculpture seen in a similar position in species of *Hoplogryon*, such as *H. cyclops*, sp. n.; 4 very slightly more than half as long as 3, strongly striate-reticulate, but the sculpture tending to become obliterated medially as in the case of 3; 6 remarkably modified (fig. 18), entirely different from that of any other Teleasine with which I am acquainted; it is densely clothed with extremely short pubescence; instead of having its apical margin more or less straight it is deeply emarginate on each side; the apical corners of the segment appear, hence, as 2 short sharp horns, which, owing to their outer side being feebly rounded, are slightly curved inwards.

Length 6.6 mm. approx.

NYASALAND (Fort Johnston), *W. A. Lamborn*, Feb. 1922, 1 ♀, taken crawling on sand.

In spite of the general lack of long hairs—these may easily have been rubbed off—and slight differences in sculpture, this female agrees in all essential details with the male of *pluto*, and I am strongly inclined to accept it as the female of that species. But as it is easier to sink a name than to erect a new one, and as I have no males from Nyasaland nor females from Cape Province, I propose to regard this unique and in many respects remarkable Teleasine provisionally as a new species. There is no question of its being congeneric with *Macrogryon pluto* and the following species. The important features are length of first segment of the funicle and shape of the sixth tergite.

Macrogryon echion, sp. n.

This species may be compared with *M. pluto*, sp. n., as follows:—

♂.—*Head* more narrowed behind. Sculpture of frons not quite so strong, but more even. Ocelli not embedded in a plexus of prominent raised rugosities; no trace of a semicircular ridge connecting them inwardly. Antennæ: funicle slightly less thick and without the characteristic glabrous appearance of *pluto*; this is because the hairs are denser, and though excessively

short are semi-erect and can be seen projecting from the sides of the segments; these differences in funicular clothing are only of degree and difficult to appreciate unless both species are available for comparison.

Thorax without such conspicuous upstanding hairs as in *pluto*, the general clothing shorter, more brownish, and, whatever upstanding hairs are present, much sparser. Striations of the mesonotum less strong, but closer and more regular. Scutellum more closely reticulated; lateral teeth straight, but similar in size. Postscutellar spine longer, narrower, and more or less straight, not thick when seen from the side nor reticulated along its sides (fig. 3 *d, e*); it projects distinctly above the level of the disc of the scutellum in lateral aspect. Lateral areas of the propodeum without the clearly marked areas of *pluto*; there are three or four distinct longitudinal carinae on each side, but these are wrinkled and connected together by irregular transverse rugae; fine hairs occur in each division, but where they are thickest (towards the sides of the propodeum) they are not so dense as in *pluto*. Hind wings much less abruptly narrowed basally (fig. 15 *c*).

Abdomen slightly more elongate, 19:17, and less rounded apically.

Length 5 mm. approx.

CAPE PROVINCE (Port St. John), Nov.-Feb., 6 ♂♂.

Macrogryon echion is very distinct from *M. pluto*. The most determinative character for the separation of the two species is the shape and direction of the postscutellar spine.

The only other described Teleasinae from the Ethiopian region are apparently the two following species, with both of which I have refrained from dealing as they are known to me only from Kieffer's descriptions:—

- (1) *Hoplogryon kenyæ* Kieff., Das Tierreich, Lief. 48, Scelionidæ, p. 236, ♂.
- (2) *Paragryon antricola* Kieff., Das Tierreich, Lief. 48, Scelionidæ, p. 214, ♂♀.

XVI.—*New Species of Lasiocampidæ from Neotropical Countries.* By W. SCHAUS.

[Concluded from p. 66.]

Euglyphis oslacia, sp. n.

Male.—Palpi cinnamon-buff, tipped with white on third joint; head, collar, and thorax thickly mottled with drab, fuscous, and white hairs; the base of hairs around the eyes black; abdomen vinaceous-fawn; a small dorsal hair-brown tuft at base; anal hairs like thorax. Fore wing: base of inner margin vinaceous-fawn, above it snuff-brown irrorated with silvery scales chiefly in cell; antemedial line double, fuscous, filled in with snuff-brown, outangled on costa, then sinuous and inbent, below cell single, vertical; medial space whitish with some dark irrorations, from cell to inner margin suffused with pinkish vinaceous; a fuscous spot at end of cell; postmedial line fine, black, slightly excurved on costa, inbent to vein 6, then slightly out-curved, minutely lunular, distally edged with silvery scales and preceded by scattered similar scales; space to subterminal line whitish, irrorated with silvery scales; subterminal line fine, hair-brown, lunular dentate, sinuous, incurved between veins 6 and 5; the veins terminally fuscous. Hind wing from base to termen vinaceous-fawn; costal margin mottled hair-brown and grey; a fine subterminal lunular line, the dark veins from it forming marginal spots, faint towards anal angle. Wings below largely dull pinkish buff, with some dark suffusions; the subterminal line faintly indicated.

Expanse 40 mm.

Habitat.—Campo Bello, Prov. of Rio.

Type.—Cat. No. 34584, U.S. N. M.

The species is nearest *E. canescens* Dognin.

Euglyphis viridisuffusa, sp. n.

Male.—Head and thorax and abdomen terminally thickly mottled drab and drab-grey, the abdomen dorsally on basal half with long fuscous tufts. Fore wing light greyish olive faintly suffused with green; costal margin to postmedial line with darker suffusions, also the cell and base of inner margin; subbasal small black spots

on costa and below cell, almost connected; antemedial line fine, dentate on costa; medial line also fine, dentate on costa and outbent to a black point at end of cell, below this inbent and indistinct; postmedial line out-angled on costa, closely followed by a fainter parallel line; subterminal line like all the lines more heavily marked on costa outcurved, then sinuous, macular, somewhat lunular, preceded from costa to vein 5 by a paler shade; a similar shade on inner margin from antemedial line to tornus. Hind wing: basal half to fuscous medial line Dresden-brown, then slightly paler to anal angle; a streak in base of cell, and hairs on base of inner margin light vinaceous-cinnamon; costal space on outer half and on termen to vein 4 similar to fore wing with darker postmedial shade, and a subterminal hair-brown line, macular between apex and vein 5, then continuous. Wings below cinnamon-drab on basal half, the outer half vinaceous-buff with traces of subterminal macular line; termen narrowly light vinaceous-fawn, and similar spots on cilia.

Expanse 44 mm.

Habitat.—Campo Bello, Prov. of Rio.

Type.—Cat. No. 34562, U.S. N. M.

Received from J. F. Zikan.

Euglyphis godeberti, sp. n.

Female.—Head vinaceous-buff; collar wood-brown; thorax and abdomen avellaneous; a small fawn-coloured tuft dorsally at base of abdomen. Fore wing avellaneous finely irrorated with wood-brown, the lines benzo-brown; a pale vinaceous shade at base of inner margin with a dark streak above it below cell; base of costa darker; a fine antemedial line from below cell at vein 3, inbent to vein 1; cell fuscous from beyond base to a round fuscous spot at end of cell, partly interrupted by a spot of ground-colour; postmedial line slightly outbent on costa, then wavyly downbent to inner margin, its distal edge pale with a faint parallel darker shade; subterminal line not so fine, outcurved at costa, macular, incurved below vein 6 and below vein 3; cilia fuscous. Hind wing cinnamon-drab; apex from the incurved postmedial line, and termen to vein 4 like the fore wing, the subterminal line very irregular, fine; a terminal dark line

on the interspaces. Wings below vinaceous-drab with traces of subterminal line on interspaces.

Expanse 41 mm.

Habitat.—Godebert, Maroni River, French Guiana.

Type.—Cat. No. 34566 U.S. N. M.

Euglyphis patchetti, sp. n.

Male.—Head, shoulders, and metathorax ochraceous-fawn mottled with dark hairs; collar and thorax benzo-brown; abdomen cinnamon suffused with drab, the anal hairs below snuff-brown; a transverse tuft of bister hairs dorsally on base of abdomen. Fore wing: medial space below cell to inner margin and terminal space fawn-colour; some cinnamon hairs at base of inner margin; a black streak at base of cell, and some white scales above it on costa; traces of an antemedial line on costa; postmedial line outcurved consisting of short black streaks between the veins only faintly indicated below vein 4, on costa preceded by a greyish space with a white streak on subcostal from vein 6 to a fine fuscous line on discocellular; some white on costa from postmedial to subterminal line crossed by a buffy-brown line; subterminal line fine, black, outcurved from costa, proximally edged with white from costa to vein 6; incurved opposite cell, macular below vein 4 to inner margin; veins from cell fuscous. Hind wing sayal-brown from base and below subcostal and vein 5 to termen whitish with a medial fine line on costa; an irregular double postmedial line to vein 5 and a fine subterminal line to anal angle; the termen below vein 4 clay-colour on interspaces. Fore wing below: the veins broadly cinnamon-buff, the interspaces drab; the postmedial line indicated, the subterminal distinct at costa, linear, below vein 6 cut by veins. Hind wing below as above, but the white space reduced and narrow at apex.

Expanse 40 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34577, U.S. N. M.

Collected by S. C. Pritchett.

Allied to *E. semita* Schs.

Euglyphis lascorina, sp. n.

Male.—Head and collar greyish white with a few black hairs; thorax and patagia dusky drab; abdomen

with fuscous dorsal tufts on basal half, the terminal half drab with pinkish-buff transverse lines. Fore wing: inner margin to cell and termen light cinnamon-drab; a black line from base on median vein to antemedial line, below cell the antemedial acutely outangled on vein 1, above median sinuously upbent to costa, enclosing a triangular white spot from base, outwardly enclosing some small spots of ground-colour, and two small whitish spots, one in cell, the other on costa; space beyond from vein 5 to costa white to postmedial line, this latter fine, deeply outbent below costa, partly double, incurved to vein 5, lunular to vein 1 and deeply inbent on inner margin near the antemedial line; subterminal line fine, black, parallel with postmedial, proximally edged with whitish, less so below vein 4; fuscous streaks on veins terminally; cilia mostly hair-brown. Hind wing brownish cinnamon from base, above median and vein 4 to inner margin, the costa and termen above vein 4 white crossed by a fine dark medial line, a diffuse postmedial and a fine subterminal line; termen toward anal angle paler. Wings below light cinnamon-drab on interspaces, the veins pale cinnamon-buff; on fore wing the postmedial and subterminal lines present on costa, on hind wing only the medial line on costa and some faint white at apex and termen to vein 3.

Expanse, male 31 mm., female 49 mm.

Habitat.—French Guiana (Nouveau Chantier).

Type.—Cat. No. 34576, U.S. N. M.

Allied to *E. lascoria* Druce.

Euglyphis nennia, sp. n.

Male.—Head whitish with a central dark line; collar and thorax fuscous, the former whitish laterally; abdomen light cinnamon-drab becoming drab-grey terminally, the basal half with large dorsal fuscous tufts. Fore wing: base of inner margin and termen ecru-drab, a short fuscous streak on base of median vein, above it a white space with a pinkish-buff line on it, limited by the outangled drab antemedial line which is closely followed by the medial parallel line, the two conjoined below cell; a small black lunule at end of cell; medial space between veins 5 and 1 dusky drab cut by the darker veins; above vein 5 the space between the medial and

postmedial lines white irrorated with ecru-drab; post-medial line fine, black, outcurved on costa, minutely dentate, then vertical to inner margin, followed closely by a fainter parallel line; subterminal line fine, black, dentate, inbent between veins 6 and 5 and again at vein 2; the veins on termen finely black; cilia fuscous on interspaces. Hind wing: the inner margin broadly army-brown; costal margin from near base and above median also the termen white; a slight postmedial line on costa; subterminal line very fine, dentate towards anal angle; a fine dark terminal line at apex; cilia fuscous on interspaces tipped with white. Fore wing below avellaneous, the postmedial line indicated, the subterminal line more distinct, but not so dentate as above. Hind wing below: the inner margin pale tawny olive, the wing otherwise white with only the terminal line.

Expanse 42 mm.

Habitat.—Sta. Catharina, Brazil.

Type.—Cat. No. 34578, U.S. N. M.

Nearest *E. vithersi* Schs.

Euglyphis yahuarmaya, sp. n.

Male.—Head light vinaceous-fawn; collar dorsally and thorax raw umber, collar otherwise and patagia deep mouse-grey; abdomen argus-brown with dorsal bister tufts on three basal segments. Fore wing buffy brown suffused with citrine-drab; base below cell and inner margin narrowly pinkish cinnamon; antemedial line very faint with a white point on vein 1; a black point at end of cell; postmedial line consisting of white points on veins, excurved on costa; subterminal line dark, diffuse from a small spot on costa, incurved at vein 6, lunular from vein 4 to inner margin; veins on termen black; cilia with light pinkish-cinnamon spots at veins. Hind wing: costal margin and termen to vein 5 like fore wing; a postmedial fine whitish line from costa to vein 6; wing otherwise brownish russet; the subterminal line with projecting black streaks on veins forming terminal spots. Wings below cinnamon-buff with darker interspaces on fore wing, also traces of subterminal line; both wings with light pinkish-cinnamon spots on the dark cilia.

Expanse 42 mm.

Habitat.—Yahuarmaya, Peru.

Type.—Cat. No. 34575, U.S. N. M.

Nearest *E. fusconigra* Dognin.

Two males in Dognin collection.

Euglyphis cantella, sp. n.

Female.—Head, collar, and thorax quaker-drab mottled with white and fuscous hairs. Abdomen light drab. Wings whitish very thickly irrorated with light drab. Fore wing: hair-brown streaks on costal margin, in and below cell, crossed by darker basal, subbasal, and antemedial broad lines, closely followed by a fine medial blackish line, angled at vein 5, then inbent, sinuous; a small dark spot at end of cell; postmedial line fine, dark, outcurved on costa, incurved between veins 7 and 5, and with white points on veins; subterminal line black, fine from costa consisting of small spots, below vein 6 linear, broader, slightly incurved above vein 5, and again below vein 3 to tornus; cilia light buff with drab spots at veins. Hind wing: a thick black medial line, slightly outbent on costa and inbent to vein 3; inner margin to beyond middle broadly brownish-fawn colour; a very faint, irregular, subterminal line; cilia as on fore wing.

Expanse 54 mm.

Habitat.—Sta. Catharina.

Type.—Cat. No. 34596, U.S. N. M.

Euglyphis moridens, sp. n.

Male.—Body and wings avellaneous. Fore wing: veins and discocellular finely wood-brown; cilia cinnamon-drab. Hind wing: from base a semihyaline space extends below vein 7 to near termen, expanding to vein 3; on costa a pale outer line to vein 7. Wings below somewhat paler.

Expanse 36 mm.

Habitat.—Virginia, S. Minas Geraes, Brazil.

Type.—Cat. No. 34541, U.S. N. M.

Belongs to the group of *E. juliana* Schs., *E. giulia* Schs., *E. morens* Schs., and *E. talma* Schs., all of which have veins 8 and 9 on hind wing from a point.

Collected by J. F. Zikan.

Euglyphis indrosia, sp. n.

Male.—Head greyish drab. Thorax drab. Abdomen light cinnamon-drab. Fore wing: base hair-brown with a double darker subbasal line; antemedial line triple, filled in with white, the lines slightly inbent and minutely wavy; medial space from costa to median vein avellaneous, thickly irrorated with pale drab-grey scales from cell to inner margin with fewer irrorations, this avellaneous portion extending to near termen; postmedial line fine, hair-brown, minutely wavy, excurved at costa, angled and inbent to vein 5, then downbent and almost vertical; space beyond similar to medial space; a subterminal dark spot on costa from which the subterminal line is outbent to near termen, then incurved from vein 6 to vein 4, again outbent, angled and sinuous to inner margin; at veins 6 to 4 a slight hair-brown spot; cilia with whitish spots on interspaces. Hind wing: base and inner margin cinnamon-drab with army-brown hairs along inner margin; a medial dentate fuscous line from costa to vein 4 followed by a large white space slightly irrorated with light cinnamon-drab; subterminal line dark, irregular from costa to vein 2 followed by whitish spots on interspaces, smaller and fainter towards anal angle. Fore wing below vinaceous-buff from costa to median vein, below it avellaneous; postmedial line distinct, smooth; subterminal slightly darker, broad, also smooth. Hind wing below: base broadly avellaneous, edged by a dark, somewhat incurved line, downbent near inner margin; outer space whitish with some vinaceous-buff irrorations; a faint, darker, subterminal, irregular shade; cilia with drab spots.

Expanse 41 mm.

Habitat.—Virginia, S. Minas Geraes, Brazil.

Type.—Cat. No. 34536, U.S. N. M.

Received from J. F. Zikan.

Euglyphis isolina, sp. n.

Male.—Head and front of thorax hair-brown, the thorax posteriorly fuscous; abdomen drab, the anal hairs fuscous. Fore wing: basal third fuscous limited by a double black line straight from costa to below vein 2, slightly inset below it to inner margin, crossed by cinnamon-brown streaks on interspaces, also with a thick

black subbasal dash from within cell to submedian, some white on outer side of the line closely followed by a black point in cell; balance of wing light silky drab largely suffused with brownish drab; postmedial line fine, somewhat sinuous defined by whitish distally; subterminal line dark, macular, incurved opposite cell and above inner margin; termen and cilia darker-shaded. Hind wing above silky drab, suffused on basal half with cinnamon-drab; outer half of costa and apex more whitish; a darker medial line from costa to inner margin, a subterminal macular dark shade. Fore wing below with basal half vinaceous-buff followed by a smooth dark postmedial line outcurved on costa; outer half light cinnamon-drab crossed by vinaceous-buff veins; subterminal line regular, very faint. Hind wing below: basal half vinaceous-buff, the interspaces and veins beyond as on fore wing; a black medial spot on costa and a vertical indistinct dark line below it to inner margin.

Expanse 38 mm.

Habitat.—Pueblo Guasco, Colombia.

Type.—Cat. No. 34539, U.S. N. M.

Five specimens received from F. Johnson.

Euglyphis hyalescens, sp. n.

Male.—Head, collar, and thorax light drab mottled with darker striæ, the patagia outwardly edged with fuscous. Abdomen army-brown with transverse fuscous bands. Fore wing: base fawn-colour, the costa fuscous; a black point in cell, below it outset a small white mark, the whole limited by a double black antemedial line filled in with wood-brown, curved from costa to near base of inner margin; the outer space semihyaline mouse-grey, the veins finely dark with small points on them on either side of the paler lines; postmedial line slightly broader on costa where outangled to vein 10, edged on either side by a faint darker shade; subterminal line outbent below costa, sinuous to inner margin. Hind wing: costa at base fuscous limited by a white medial line, the inner margin broadly Saccardo's-umber; apex to vein 5 broadly semihyaline pale ecru-drab, below vein 5 to tornus faintly hyaline along termen; cilia on both wings saccardo's-umber faintly tipped with vinaceous-

fawn, and similar points at tips of veins. Wings below with the markings fainter.

Expanse 34 mm.

Habitat.—Pueblo Guasco, Colombia; Incachaca, Bolivia.

The Bolivian specimens are not so fresh and have the terminal portion of hind wing hyaline to vein 2.

Type.—Cat. No. 34586, U.S. N. M.

Euglyphis luciana, sp. n.

Male.—Palpi whitish buff, mottled with fawn-colour; collar sayal-brown; patagia and thorax mottled white, black, and fawn-colour. Abdomen cinnamon-drab, the anal hairs tipped with fuscous. Fore wing: basal third light pinkish cinnamon with benzo-brown spots, subbasal on costa and below cell, 5 antemedial on interspaces followed by a fine white line and then by the medial fine black line which is faintly wavy and vertical and is followed by a rather broad white space; postmedial line also fine, dark, distally edged with white incurved between veins 7 and 4, below 4 slightly wavy and vertical to inner margin; terminal space light vinaceous-fawn; a fine darker subterminal line expanding and incurved between veins 6 and 4, distally edged with whitish; the veins on termen somewhat darker. Hind wing: the costa and apex to vein 4 white with some dark irrorations; a black medial inbent line on costal margin; inner margin below cell and vein 4 sayal-brown; an irregular subterminal dark line, widest below apex. Wings below vinaceous-fawn with traces of the subterminal line.

Expanse 38 mm.

Habitat.—Teffé, Amazons.

Type.—Cat. No. 34597, U.S. N. M.

From the Dognin Collection.

Closely allied to *E. teramba* Schs., but differs in colour and basal markings of fore wing.

Euglyphis teramba, sp. n.

Male.—Head drab; collar chestnut in front, posteriorly also front of thorax cinnamon-drab with a few white hairs; tegulae thickly mottled with white hairs. Abdomen cinnamon-drab. Fore wing: base cinnamon-drab crossed by a benzo-brown, thick, subbasal line, distally limited

by a fine double black antemedial line, filled in by a fine white line, and followed by a broad white fascia irrorated with benzo-brown before the postmedial line; postmedial line outcurved on costa, incurved opposite cell, then sinuous, almost vertical, with small white spots on veins distally; terminal third light cinnamon-drab scaling on a whitish ground, the veins irrorated with English-red; a diffuse and very irregular subterminal shade; a terminal fine reddish line; cilia with pale spots on interspaces. Hind wing dark cinnamon-drab; costal margin and termen to vein 3 whitish irrorated with black and drab scales. Wings below light cinnamon-drab, the veins and costal edge pinkish buff; the subterminal line better defined.

Expanse 40 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34542, U.S. N. M.

Belongs near *E. prodiga* Draudt.

Euglyphis lucedia, sp. n.

Female.—Vertex vinaceous-fawn; collar and thorax light cinnamon-drab; abdomen cinnamon-drab, the anal segment vinaceous-fawn. Fore wing: from base to beyond middle a large Hay's-russet patch limited by the antemedial line which is cinnamon-brown, distally edged with pinkish buff, and another finer dark parallel line, and is bluntly outcurved from costa inset at vein 6, again outcurved and inbent to vein 2 antemedially, then inbent to base; the line is followed from costa to vein 6 by a whitish space to postmedial line, below vein 5 to inner margin by greyish irrorated with Hay's russet; postmedial line outangled at costa, then parallel with termen, mostly lunular, pinkish buff, followed by a Hay's-russet shade with darker streaks on veins; subterminal line fine, white darkly edged, close to termen; cilia pinkish buff with large dark spots. Hind wing dark cinnamon-drab; a postmedial white line from costa to vein 6; a fine intermedial white wavy line from apex to vein 3. Fore wing below fawn-colour, the subterminal line faint proximally with short dark streaks on veins. Hind wing below cinnamon-drab.

Expanse 40 mm.

Habitat.—Brazil.

Type.—Cat. No. 34583, U.S. N. M.

The type from the Neumoegen Collection is simply labelled Brazil. Another specimen in the National Museum from Sta. Catharina has the large patch somewhat darker, and there is more grey at the apex of the hind wing.

Euglyphis flaviana, sp. n.

Male.—Head avellaneous; collar and thorax drab, the vertex fuscous, the patagia laterally pinkish buff. Abdomen above fawn-colour with dorsal dark tuft at base, laterally and underneath pinkish buff. Fore wing: base pinkish buff to the medial double, fine, dark lines which are slightly outcurved; postmedial space light drab to the fine double postmedial line, which is slightly sinuous, separated and followed by a narrow pinkish-buff line; termen broadly dark vinaceous-drab crossed by the fine black, sinuous, postmedial line. Hind wing: basal half pinkish cinnamon, a dark postmedial line on costa followed by drab-grey to apex and vein 6 crossed by the subterminal dark vinaceous-drab line, and similar shading along termen. Wings below light pinkish cinnamon, the fore wing with a subterminal hair-brown fascia; costal margin of hind wing darker with traces of the postmedial and subterminal lines.

Expanse 35 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34598, U.S. N. M.

Allied to the *E. larunda* group.

Euglyphis geroides, sp. n.

Male.—Very similar to *E. gera* Schs. Fore wing: the base light buff with a fuscous spot on costa, and limited by the double fine, black, outcurved antemedial line; medial space drab-grey, with a short dark line on discocellular; postmedial line vinaceous-buff cut by veins on costa, proximally minutely dentate from vein 5 to inner margin; terminal space darker, the subterminal line fine, light buffish, wavy. Hind wing light buff at base changing to cinnamon-drab; the costa and apex to vein 5 greyish olive with a thick whitish subterminal sinuous line to vein 3. Fore wing below whitish at base and on inner margin, the outer half light vinaceous-fawn, the veins pinkish buff; postmedial

black spots on interspaces, largest at costal margin. Hind wing below light vinaceous-fawn, paler along inner margin; postmedial black spots before apex distally edged with white which indistinctly continues as a pale line.

Female as in *E. gera*, smaller with markings less distinct.

Expanse, male 25 mm., female 32 mm.

Habitat.—Villa Rica, Paraguay.

Type.—Cat. No. 34582, U.S. N. M.

Probably only a local race.

Euglyphis amatura, sp. n.

Male.—Body light cinnamon-drab. Fore wing mostly light cinnamon-drab; antemedial line fine, black, broader on costa, very irregular, vertical, preceded by some white scaling to a basal benzo-brown line; postmedial line hair-brown, inangled on costa, then vertical to inner margin, minutely lunular, narrowly edged distally with avellaneous; subterminal line hair-brown, macular, sinuous; cilia with hair-brown spots on interspaces. Hind wing mostly light brownish drab, suffused with sorghum-brown on inner margin; a fuscous postmedial line from costa to vein 6, outwardly edged with grey; a fine dark subterminal line at apex to vein 6. Fore wing below with terminal space drab, the veins vinaceous-buff. Hind wing below as in fore wing, the postmedial line longer, the subterminal line more extended.

Expanse 29 mm.

Habitat.—Amatura, Amazons.

Type.—Cat. No. 34585, U.S. N. M.

From Dognin Collection.

Euglyphis olivetta, sp. n.

Male.—Antenna cinnamon. Head and thorax mottled pale ecru-drab, wood-brown, and fuscous hairs, the latter chiefly on collar. Abdomen yellow-ochre; a dorsal Natal-brown tuft at base, partly formed by similar tips of hairs from metathorax; underneath light pinkish cinnamon. Fore wing whitish, thickly irrorated with wood and buffy-brown scales, less so on apical space and termen which are faintly suffused with pinkish buff; base of costa with an oblique fuscous line; base of inner margin yellow-ochre; a fine sinuous antemedial dark

line; a dark point at lower angle of cell; a subterminal series of buffy-brown spots on interspaces, those from costa to vein 7 small, those below vein to inner margin lunular distally, dentate proximally, incurved between veins 6 and 4. Hind wing yellow-ochre, darker-shaded along inner margin; costal margin, apex broadly, and termen narrowly whitish; a dark subterminal line incurved at apex, then sinuous, not forming spots. Wings below yellow-ochre, suffused with pinkish cinnamon; subterminal spots on fore wing indicated, the line on hind wing somewhat macular.

Expanse 39 mm.

Habitat.—Trinidad, B.W.I.

Type.—Cat. No. 34600, U.S. N. M.

From the Dognin Collection.

Closely allied to *E. pseudamida* Dogn.

Euglyphis tamira, sp. n.

Male.—Very similar to *E. tupmila*, but differs in the following respects. The thorax is drab-grey with darker suffusions on collar; abdomen cinnamon-drab; on the fore wing the lines are different, the antemedial forming three lunules, the postmedial straighter, the subterminal more even. Hind wing concolorous with abdomen, the white space at costa very similar. Wings below darker, cinnamon-drab. Fore wing with postmedial line prominent, the subterminal line distinct, macular and incurved between veins 7 and 4. Hind wing below with only faint traces of the white beyond the postmedial line at costa, the subterminal line macular, distinct.

Expanse 34 mm.

Habitat.—Itatiaya, Prov. Rio, Brazil.

Type.—Cat. No. 34535 U.S. N. M.

Four specimens in Nat. Mus.

Allied to *E. pseudamida* Dogn.

Euglyphis tupmila, sp. n.

Male.—Pectinations of antenna avellaneous. Frons and vertex laterally fuscous, above with greyish lines; collar and thorax greyish brown; abdomen drab-grey; fore tibia with prominent drab-grey tufts, the hind tibia with vinaceous-brown tufts. Fore wing: a hair-brown patch at base of costa to close to antemedial line, and

a cinnamon-drab spot at base of inner margin; a fine, double, wavy, vertical black line on a white ground-colour with steel-grey irrorations before the postmedial line, which is fine, dark, outangled below costa, incurved to below vein 4, slightly angled and wavily downbent to inner margin, narrowly edged distally with white; space between postmedial and subterminal whitish from costa to vein 6, then suffused with drab and light cinnamon-drab, on which is a fuscous shade between veins 4 and 6 at subterminal line; subterminal consisting of dark points from costa to vein 6, then broken and continuous from vein 4 to inner margin; termen suffused with cinnamon-drab with fuscous streaks on veins terminally; cilia fuscous with greyish spots at tips of veins. Hind wing buffy brown; a postmedial inbent black line from costa to vein 6 followed by a broad white space to vein 6; a subterminal wavy dark line from apex to vein 5 followed by whitish spots on interspaces diminishing towards anal angle; terminal black lines at base of cilia from apex to vein 2. Wings below light cinnamon-drab, silky, with faint traces of postmedial and subterminal lines, the spots of cilia more prominent; the white space on hind wing greatly reduced.

Expanse 36 mm.

Habitat.—Virginia, Minas Geraes, Brazil.

Type.—Cat. No. 34534, U.S. N. M.

Collector J. F. Zikan.

Euglyphis rearensis, sp. n.

Male.—Head and body hair-brown, the dorsal hairs on basal half of abdomen chætura-drab. Fore wing thinly scaled, largely iridescent; the base narrowly hair-brown, otherwise light drab with fine darker antemedial, medial, postmedial, and subterminal lines, the veins finely hair-brown; whitish points before the antemedial line; a white spot at end of cell; whitish spots on interspaces 6–9 before the subterminal line, also at apex; the discocellular black; cilia hair-brown, tipped with light drab. Hind wing light drab, the hairs along inner margin drab; a white postmedial line on costa. Wings below paler; otherwise as above; a hair-brown patch at base of costal margin of hind wing.

Expanse 28 mm.

Habitat.—Itatiaya, Estado do Rio.

Type.—Cat. No. 34557, U.S. N. M.

Several specimens received from J. F. Zikan.

Allied to the group *E. fibra* Schs.

Euglyphis ænegia, sp. n.

Male.—Head cinnamon-buff, with fuscous hairs on vertex; collar cinnamon-drab; thorax light drab; metathorax benzo-brown extending on to basal segment of abdomen as a thick tuft; abdomen otherwise cinnamon-buff with a dorsal cinnamon-brown spot on last two segments. Fore wing mostly white to postmedial line crossed by the fine, double, black antemedial line, outangled on median at vein 3, inangled at vein 1; a fuscous line from base with an upbent line to costa, and another to vein 1, also a dark line at base of inner margin which extends to postmedial line; postmedial line black, vertical, closely followed by a finer line, the space between them pinkish drab; termen broadly light cinnamon-drab; a faint, irregular, subterminal line. Hind wing white; a postmedial vertical black line; a subterminal line from apex to vein 6, then very faint and lunular to anal angle; the inner margin from below cell to anal angle cinnamon-buff. Fore wing below pinkish buff to the postmedial line; the interspaces on terminal half drab, the veins pinkish buff. Hind wing below almost as above, the subterminal line hardly traceable, the inner margin more of a light pinkish cinnamon-buff.

Expanse 33 mm.

Habitat.—Monte Christi, Amazons, and other localities.

Type.—Cat. No. 34574, U.S. N. M.

Belongs to the group of *E. fibra* Schs.

Distinguished by the absence of white markings on termen, from *E. directa* Schs. by a narrower white medial space.

E. cinialis Draudt is a synonym of *E. necopinella* Dognin.

Euglyphis metrana, sp. n.

Male.—Head drab, the palpi orange-buff; collar and thorax deep greyish olive; abdomen orange-buff, the three basal segments dorsally and the two terminal segments dark greyish olive; thorax below light pinkish buff mixed with grey. Wings white, the veins finely

black. Fore wing: a fine double dark antemedial line outcurved from costa to vein 1, where it suffuses with a dark grey basal spot below cell; postmedial line fine, double, filled in with light drab, slightly outcurved on costa, inset on vein 7, then inbent to near middle of inner margin; subterminal line single, inangled at vein 10, outcurved to below vein 6, outangled on veins 4 and 3 and incurved to tornus, the space before it to postmedial suffused with light mouse-grey; a fine black terminal line. Hind wing at base dull orange-buff, changing on inner margin to hair-brown; postmedial black line on costa angled and downturned at vein 7, the space beyond to subterminal line light mouse-grey, this latter line faint, the terminal spots between the veins white.

Expanse 33 mm.

Habitat.—New Bremen, Sta. Catharina.

Type.—Cat. No. 34552, U.S. N. M.

Received from Fritz Hoffmann.

Euglyphis marica, sp. n.

Male.—Head, collar, and thorax mottled hair-brown, greyish-cinnamon, and fuscous hairs; metathorax fuscous, also a long tuft of hairs on basal segment of abdomen which is otherwise wood-brown with darker transverse bands; laterally at base of abdomen, the base of inner margin, and the abdomen below light pinkish cinnamon. Fore wing: base narrowly dark mouse-grey, followed by three white spots divided by dark veins; antemedial line double, outcurved from costa to above vein 1, then outbent, filled in with light ochraceous-buff; medial space white cut by the dark veins; postmedial line double, also filled in with light ochraceous-buff, outcurved on costa and sinuously inbent to middle of inner margin; terminal space pale drab-grey; subterminal line slightly dentate from costa to vein 6, then deeply dentate to tornus; the medial line is followed between vein 3 and inner margin by a wood-brown shade. Hind wing white on costa and termen, the inner margin light pinkish cinnamon followed by a tawny-olive shade; veins mostly fine, dark mouse-grey; an angled subterminal line at apex. Wings below more faintly marked.

Expanse 35 mm.

Habitat.—Santo Domingo, Peru.

Type.—Cat. No. 34573, U.S. N. M.
From the Dognin collection.
Four specimens received.

Euglyphis pumayaca, sp. n.

Male.—Antenna brown. Head deep mouse-grey. Thorax white with slight dark mottling; abdomen light mouse-grey above, anal hairs and underside dark mouse-grey. Fore wing dark mouse-grey; inner margin broadly white, less so at base and tornus; a basal and a double wavy antemedial black line; a postmedial black line, outcurved on costa, then very fine, sinuous; a subterminal series of small black spots, slightly outcurved from costa, followed by a fine black line partly defined by white near tornus; only faint traces of lines on white inner margin. Hind wing olivaceous-black with faint traces of a paler subterminal broken line. Wings below dark mouse-grey. Fore wing: inner margin white; veins light drab; termen mouse-grey; subterminal black spots elongated and suffusing with ground-colour. Hind wing: termen deep mouse-grey, subterminal dark spots as on fore wing forming a sinuous line.

Expanse 32 mm.

Habitat.—Pumayaca, Peru.

Type.—Cat. No. 34538 U.S. N. M.

Received from Mr. Frank Johnson, a very distinct species. Three specimens received.

Euglyphis asapha, sp. n.

Male.—Palpi vinaceous-buff; vertex, collar, and patagia avellaneous; abdomen above avellaneous with some darker shading; body below mostly vinaceous-buff, the fore tibia white. Fore wing: a white point at base below cell; a subbasal black streak in cell and a larger streak below cell; costal margin beyond broadly creamy white to the subterminal pinkish-cinnamon lines; two black points on discocellular; medial space from vein 6 to inner margin drab, its distal edge somewhat crenulate and edged by a pale postmedial fine line, which is followed between veins 3 and 6 by some drab, below vein 3 to inner margin by vinaceous-buff; subterminal small hair-brown spots from vein 9 to vein 6 distally edged by fine white lines, which continue as a sinuous

line to tornus, its proximal edge between veins 6 and 4 benzo-brown, below vein 4 preceded by clay-colour spots; a fine terminal whitish-buff line; cilia hair-brown. Hind wing: costal margin broadly light buff, otherwise light drab with a diffuse medial dark shade. Fore wing below: costal margin broadly light ochraceous-buff, otherwise with dark suffusions and subterminal spots, all very indistinct. Hind wing below uniformly light buff.

Expanse 41 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34599, U.S. N. M.

Can be placed near *E. lyso* Druce.

Euglyphis lillia, sp. n.

Male.—Head and thorax fuscous mottled with white hairs, also metathorax and last two segments of abdomen; abdomen medially avellaneous with a medial tuft of benzo-brown scales. Fore wing largely fuscous, the hairy scales on wing upturned, partly white; a fuscous-black spot at base below cell; antemedial short whitish streaks on costa and inner margin, a few white points indicating the line; a medial round light greyish-olive spot above submedian; a black mark at end of cell; postmedial consisting of minute pale points on veins outcurved at costa, then inbent, connected by a fuscous shade preceded and followed by a light cinnamon-drab shade, proximally reaching end of cell, distally to vein 5, but not reaching termen; a submarginal series of black spots defined by white scales; termen mostly deep greyish olive with terminal white points on veins. Hind wing Natal-brown, the costal margin mottled fuscous with whitish scales. Wings below cinnamon-drab with darker shading on interspaces; a dark postmedial thick line outcurved at costa of fore wing, inbent, continued on hind wing medially.

Expanse 32 mm.

Habitat.—Itatiaya, Estado do Rio.

Type.—Cat. No. 34537, U.S. N. M.

Received from J. F. Zikan.

Euglyphis zenona, sp. n.

Male.—Head and thorax drab, the abdomen slightly paler. Fore wing: base of costa and medial space from costa to vein 3 drab; medial space below vein 2, and

termen from costa to vein 3 light cinnamon-drab, also the base of inner margin; subbasal line fine, dark, vertical not reaching inner margin; antomedial line fine, hair-brown, inwardly pale-edged, preceded by a fuscous spot below costa, and below cell by a cinnamon-buff spot; a small black spot in medial space above vein 5, and a narrow dull ochre shade between veins 2 and 3, a similar shade beyond postmedial from vein 3 to inner margin; postmedial line fine, dark outcurved on costa, then nearly vertical to inner margin, distally with whitish points on veins 7 to 3; subterminal black spots on interspaces; cilia mostly hair-brown. Hind wing tawny-drab; a postmedial dark line preceded by benzo-brown shade on costa, and also below end of cell; a subterminal sinuous dark line. Wings below drab on interspaces, the veins pinkish buff; a fine dark postmedial line on both wings.

Expanse 34 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34540, U.S. N. M.

Three males in Nat. Mus.

Somewhat like *E. spreata* Draudt, but considerably larger.

XVII.—*Notes on Protura.*—I.

By RICHARD S. BAGNALL, D.Sc., F.R.S.E.

WHILST collecting Pauropods and Onychiurids I naturally meet with members of Protura from time to time; I therefore propose to publish a series of notes on this group. In my first contribution I am able to reinstate the genus *Proturentomon* of Silvestri and to unravel a consequent somewhat complicated synonymy. Whilst I have little doubt that the position is as now depicted, one must stress the desirability of a re-examination of the types of *Acerentomon minimum* Berlese and *Proten-tomon transitans* Ewing, if only for one's ultimate satisfaction.

The Genus Proturentomon Silv.

In 1908 Berlese (1908) described several species of Protura including *Acerentomon confine* (p. 17) and *A. minimum* (p. 18), and in the first part of his Monograph (Berlese, 1909) he characterized the genus *Acerentulus*

(with *A. confine* as genotype) for the species in which the labrum of the head is not produced as in *Acerentomon doderoi* Silv. and others.

At about the same time Silvestri (1909), having the same purpose in view and being unaware of Berlese's new genus *Acerentulus*, created the genus *Proturentomon* with *Acerentomon minimum* Berl. as genotype, which name has up to now been regarded as a synonym of *Acerentulus*.

In 1921 Ewing (1921) described *Protentomon* from the U.S.A., relying chiefly on the importance of the two-jointed first and second pairs of abdominal appendages, the second pair in *Acerentomon* and *Acerentulus* being single-jointed. Ewing's genotype, *P. transitans*, was described from a single example which as Womersley (1927) has pointed out, was probably submature. Womersley also showed that the name *Protentomon* was preoccupied, and suggested the name *Meroentomon* for Ewing's species, and, quite justifiably, divided the *Acerentomidae* into two subfamilies, *Acerentominae* and *Meroentominae*.

In this latter subfamily Womersley diagnoses two genera, *Meroentomon*, in which the tergal apodemes of the abdomen are stated to be absent and the pectines of tergite 8 apparently absent, and *Paraentomon* (genotype *P. clevedonense* Wom.), in which apodemes and modified pectines are present; he further uses a third character in the absence (*Meroentomon*) or presence (*Paraentomon*) of a minute pair of anterior setae, additional to the single row of setae on certain tergites.

As this last character is one that might quite readily have been unappreciated or overlooked by Ewing, and as the presence of abdominal apodemes and the modified pectines of tergite 8 may not be present or apparent in submature forms, I consider it unwise to recognize both genera, unless or until undoubted characters can be cited in support.

Before the synonymy can satisfactorily be cleared it is necessary to examine another factor, and that is the status of the genotype of *Proturentomon* Silv.

When Berlese (1909) included *A. minimum* in his genus *Acerentulus* he went so far as to suggest the advisability of erecting a new subgenus for this species,

on account of the form of the fore legs and their specialized tarsal sensillæ, which are as described by Womersley for his *Paraentomon clevedonense*. In April 1934 I took a female of a minute Acerentomid agreeing in size, form, and colour with Berlese's description of *Acerentulus minimum*; the genitalia agree exactly with his original figure (1908, fig. 8), as also the chaetotaxy of the head; the fore tarsus, claw, and tarsal sensillæ also agree with his description and figure, and, taking into consideration the fact that the importance of the finer details of the chaetotaxy was not then recognized, I can find nothing of importance in Berlese's other figures of *minimum* to suggest that his species is not the same as mine.

But *A. minimum* is included in a group in which one of the chief characters lies in the structure of the abdominal appendages, the first alone of which is double-jointed, and in view of the supporting characters I am forced to the conclusion that this character was not closely examined (as far as *minimum* was concerned) by Berlese, as my specimen, referred to above, agrees with Womersley's *Paraentomon* in this respect. Further, but for the coloration, my example can equally be referred to Womersley's *Paraentomon clevedonense*, its abdominal chaetotaxy agreeing to the minutest detail with Womersley's description, and I therefore consider that his *Paraentomon clevedonense* is the same species as described by Berlese in 1908, and the synonymy should be expressed as follows:—

Genus PROTURENTOMON Silv. 1909, p. 10.

Syn.: *Acerentulus* auct., p.p.

Protentomon Ewing, 1921, p. 195.

Meroentomon Womersley, 1927, p. 145.

Paraentomon Womersley, 1927, p. 145.

Proturentomon minimum (Berl.) mihl.

Syn.: *Paraentomon clevedonense* Wom., 1927.

Womersley's examples were taken in Somerset, ix. 26.

LONDON, Chiswick, 1 ♀ in a garden, iv. 34.

REFERENCES.

- BERLESE. 1908. "Nuovi Acerentomidi." 'Redia,' v. fasc. 1, pp. 16-19, pl. 1. (Aug. 1908).
 BERLESE. 1909. "Monografia dei Myrientomata." *L.c.* vi. pp. 1-182, pl. i.-xvii. (pt. i., May 29, 1909; pt. ii., Aug. 14, 1909).

- EWING. 1921. "New Genera and Species of Protura." *Proc. Ent. Soc. Washington*, no. 9 (Dec. 1921), pp. 193-202, figs. 1-13.
- SILVESTRI. 1909. "Descrizione preliminare di varii Artropodi, Specialmente d'America." *Atti Accad. Naz. Lincei, Rend.* 18, pp. 7-10 (June 1909).
- WOMERSLEY. 1927. "Notes on the British Species of Protura, with Descriptions of new Genera and Species." *Ent. Mo. Mag.* lxxiii. pp. 140-147, figs. 1-7.

XVIII.—*On a Fossiliferous Upper Triassic Shale from Pahang, Federated Malay States.* By L. R. Cox, M.A., F.G.S., Department of Geology, British Museum (Natural History).

[Plate IV.]

THIS report describes the fossil contents of a friable pink marly shale found in the Sungei Taba, four and a half miles north of the Bukit Koman shaft of the Raub Australian Gold Mining Company, near Raub, Pahang, F.M.S., and sent to me by Mr. E. S. Willbourn, Director of the Geological Survey of the Federated Malay States. This rock occurs in two thin bands separated by 20 feet of unfossiliferous dark green gritty shale.

The fossils, all of which are Lamellibranchs, consist of moulds of the original shells; they are usually distorted by pressure, but in most cases clearly preserve the details of the surface-ornamentation. The two commonest species are radially ribbed forms belonging to the genus *Myophoria*, but in breaking up a considerable quantity of the rock several other species have been discovered, so that it is possible to record the presence of eleven species in the present report. Two or three further species are represented by material too imperfect for description. In the following list the known range of each species in other areas is indicated in square brackets :—

Grammatodon malayensis, sp. n.

Modiolus raubensis, sp. n.

Modiolus cf. *raiblianus* Bittner [Carnian].

Cassianella ? sp.

Haernesia cf. *bipartita* (Merian) [Carnian].

Haernesia willbourni, sp. n.

Gervillia (*Langsonella*) *elongata* Mansuy [U. Trias].

Plicatula (*Pseudoplacunopsis*) cf. *carinata* Healey [Rhætic].

Myophoria cf. *harpa* (Münster) [Ladinian-Carnian].

Myophoria cf. *chenopus* Laube [Carnian].

Myophoricardium cf. *lineatum* Wöhrmann [Muschelkalk-U. Trias].

These determinations leave no doubt that the beds are of Upper Triassic age. That their age is pre-Rhætic appears to be indicated by the absence of such species as *Myophoria napengensis* Healey and *Burmesia linata* Healey, both of which occur commonly in Rhætic beds of comparable facies in Burma and Indo-China. It is probable that they are referable to the Carnian stage, and are approximately contemporaneous with beds at other localities in the Malay States which have yielded fossils described in two papers by R. B. Newton (1900, 1923).

The specimens figured in the present paper are deposited in the Department of Geology of the British Museum (Natural History), the numbers cited in connection with them being the registration numbers of that Department.

DESCRIPTION OF THE SPECIES.

1. *Grammatodon malayensis*, sp. n.
(Pl. IV. figs. 9, 10.)

Material.—The holotype (L. 63425, fig. 9) and six other specimens.

Specific Characters.—Small, rhomboidal, usually about twice as long as high, but occasionally much shorter. Umbo rounded, moderately prominent, placed at the anterior third of the length. Posterior slope evenly rounded, not carinate. Posterior margin rather oblique, making an obtuse angle with the hinge-margin. Ventral margin straight, parallel to hinge-margin. Anterior end of shell evenly rounded. Surface apparently smooth.

Dimensions.—Holotype: length 14.5 mm., height 7.4 mm. Least elongate specimen: length 11.7 mm., height 8.0 mm.

Remarks.—Impressions of elongate posterior lateral teeth are visible in the holotype and in the shortest specimen. This species appears to be distinct from any hitherto described from the Trias or Rhætic, but

"*Macrodon*" *esinensis* Stoppani, as interpreted by Bittner (1895, pl. xv. figs. 17, 18), may be cited as a comparable Triassic form.

2. *Modiolus raubensis*, sp. n.
(Pl. IV. fig. 2.)

Material.—The holotype only (L. 63430).

Specific Characters.—Shell elongate, narrow, parallel-sided, straight except at the posterior end, which is slightly downcurved, evenly inflated, not ridged. Buccal region comparatively large, well inflated, projecting well past the umbo, and separated from the body of the shell by a narrow well-incised groove.

Dimensions.—Length 16.2 mm., height 5.4 mm., inflation (single valve) 2.0 mm.

Remarks.—This species does not closely resemble any previously described from the Trias.

3. *Modiolus* cf. *raiblianus* Bittner.
(Pl. IV. fig. 1.)

Compare :—

Modiola raibliana Bittner, 1895, p. 48, pl. v. figs. 21, 22.

Modiola cf. *raibliana* Patto, 1926, p. 153, pl. x. figs. 11-13.

Material.—Two specimens (L. 63431-2).

Description and Remarks.—These are poorly preserved moulds of a *Modiolus*, the larger of which attains a length of about 15 mm. The smaller specimen, which is the less distorted, agrees with Bittner's fig. 21 in shape, except that its buccal region is slightly more convex; in this latter character it agrees better with Bittner's fig. 22, which represents a proportionately shorter shell.

Distribution of M. raiblianus.—Carnian of the southern Alps. Upper Trias of Tripoli. *M. cf. raiblianus*, Upper Trias of Indo-China.

4. *Cassianella* (?) sp.
(Pl. IV. fig. 3.)

Material.—One incomplete specimen (L. 63436).

Description.—The internal mould of a small left valve 7 mm. in length and 4 mm. in height, with a globose body crossed on its anterior side by a rather narrow, slightly oblique, deep, rounded sulcus. There is a long, narrow, sharply pointed posterior wing, but the anterior wing is not preserved.

This species probably belongs to the genus *Cassianella*, but appears distinct from any form previously described. The specimen is too imperfect to name.

5. *Hærnesia* cf. *bipartita* (Merian).
(Pl. IV. fig. 4.)

Compare:—

Hærnesia bipartita Bittner, 1895, p. 83, pl. x. figs. 6-9.

Material.—One specimen (L. 63437, internal and external moulds).

Description.—An elongate, rather narrow-bodied *Hærnesia*, 12.7 mm. in length and 6.0 mm. in height. A deep, wide, rounded sulcus runs from the umbo to the antero-ventral margin and delimits a large round-margined anterior lobe. The posterior wing is narrow and obtuse-angled.

Compared with *H. bipartita*, this specimen appears at first sight to be more elongated in a direction parallel to the hinge-margin, but closer examination suggests that this difference may be due to deformation in fossilization. In the specimens figured by Bittner the posterior wing is acutely pointed, but in other European specimens it may be obtuse-angled. A closely related form from the Upper Trias of Ceram has been described by Krumbeck (1923, p. 201, pl. xii. figs. 26-29) under the name *H. bipartitaeformis*, but the specimen now described appears to be closer to *H. bipartita* itself.

Distribution of *H. bipartita*.—Carnian of the northern and southern Alps and Appennines.

6. *Hærnesia willbourni*, sp. n.
(Pl. IV. fig. 5.)

Material.—The holotype only (L. 63440), consisting of the internal and external moulds of a left valve.

Specific Characters.—A moderately large *Hærnesia* with a narrow, inflated, parallel-sided body, whose major diagonal makes an angle of about 45° with the hinge-margin. A wide, deep, rounded sulcus runs across the body of the shell from the umbo, which rises prominently above the hinge-margin, to the antero-ventral margin, and is limited posteriorly by a very prominent ridge running obliquely across the body. An obtuse ridge posterior to this delimits the body from the posterior

wing, which is pointed at its tip, but is obtuse-angled in general shape. The anterior auricle is small, swollen, and acutely pointed.

Dimensions.—Length 36 mm., height 28 mm.

Remarks.—The pointed shape of the anterior auricle is best seen on the internal mould, which is not figured. The prominence of the ridge, which delimits the sulcus of the body of the shell on its posterior side, appears to have been original and not due to crushing, and is the main distinctive character of the species. In *H. sturi* Wöhrmann var. *austriaca* Bittner (1895, pl. x. fig. 5) a comparable ridge is fairly prominent, but in that form the second and more obtuse ridge delimiting the wing is absent, and the wing itself is much less expanded. No other species is at all closely comparable.

7. *Gervillia* (*Langsonella*) *elongata* Mansuy.

(Pl. IV. fig. 6.)

Gervillia (*Cultripsis*) *elongata* Mansuy, 1919, p. 7, pl. i. fig. 17.

Langsonella elongata Patto, 1926, p. 139, pl. ix. fig. 22.

Material.—One specimen (L. 63441), an internal mould.

Remarks.—This specimen agrees very closely with the above-cited figures of this peculiar species. It is possible that a second and still more elongate specimen (L. 63442) may be a distorted representative of the same species.

Distribution.—Upper Trias of Na Cham (Tonkin).

8. *Plicatula* (*Pseudoplacunopsis*) cf. *carinata* Healey.

(Pl. IV. figs. 7, 8.)

Compare :—

Plicatula carinata Healey, 1908, p. 48, pl. viii. fig. 2.

Material.—Six external moulds (L. 63445–50).

Description.—Very variable in shape. The best-preserved specimen attains a height of about 14 mm. and a length of about 9 mm. The surface is ornamented with very fine, fan-wise radiating, dichotomous threads, just visible to the naked eye; these are crossed by irregular concentric growth-undulations. Unfortunately, no internal mould of the hinge-region has been preserved.

Remarks.—It is probable that these specimens belong to the species from the Rhætic of Burma described by Healey as *P. carinata*. The radial threads are more conspicuous than in the species recorded by the same author (1908, pl. viii. figs. 4–6) as "*Placunopsis* cf.

mortilleti Stoppani." The subgenus *Pseudoplacunopsis* has been discussed by me in former papers (1924, 1932). *P. (P.) fissistriata* (Winkler), forms possibly identical with which have been described by Krumbeck (1913, p. 45, pl. ii. fig. 17; 1914, p. 241, pl. xvi. fig. 9) from the Upper Trias of Buru and Sumatra, attains a larger size than any of the specimens now recorded.

Distribution of P. (P.) carinata.—Rhatic of Burma.

9. *Myophoria* cf. *harpa* (Münster).

(Pl. IV. figs. 12-17.)

Compare :—

Myophoria harpa Bittner, 1895, p. 91, pl. xii. figs. 15-19.

Myophoria cf. *inæquicostata* Klipst., Mansuy, 1908, p. 69, pl. xviii. figs. 1-4.

Myophoria sp., Patte, 1926, p. 175, pl. xi. fig. 16.

Material.—Numerous specimens (L. 63451-64).

Description.—A costate *Myophoria*, in which the length (which ranges up to about 12 mm.) does not greatly exceed the height, and which is characterized by a high shoulder-like postero-dorsal angle, formed by the sub-horizontal postero-dorsal margin and the subvertical posterior margin. There are 6-7 sharp radial ribs, the spaces between which decrease in width towards the anterior end of the shell; the most posterior rib is not prominent enough to constitute a marginal carina. Usually the ribs are of equal prominence, but occasionally they alternate in strength, while in some shells where the main ribs are subequal a weak radial thread may occupy the space between the first and second ribs. The ribs may be smooth or denticulate, the valves in which the denticulation is most conspicuous being apparently left ones. The growth-lines are usually conspicuous in the intercostal spaces, and are arched upwards to a slight extent. A straight ridge adjacent to the postero-dorsal margin apparently delimits a narrow escutcheon.

Remarks.—Patte (*loc. cit.*) has discussed the various forms referred to *M. inæquicostata* in Mansuy's monographs, and has shown that the majority are more closely related to other species. The specimens now recorded may be conspecific with those from the Upper Trias of Indo-China represented in the figures cited above. They belong to a species closely comparable to *M. harpa*, in which a similar high postero-dorsal angle is developed.

The ribs appear, however, to be slightly less regularly arranged than in that species, if we may judge by Bittner's figures. *M. seranensis* Krumbeck (1923, p. 209, pl. xiii. figs. 8-13), from the Upper Trias of Ceram, has more numerous and closely spaced ribs.

Distribution of M. harpa.—Ladinian and Carnian of the southern Alps and Dinarids.

10. *Myophoria* cf. *chenopus* Laube.
(Pl. IV. figs. 18-23.)

Compare :—

Myophoria chenopus Bittner, 1895, p. 99, pl. xi. figs. 15-17.

Material.—Several specimens (L. 63465-78).

Description.—An elongate, posteriorly tapering, and obliquely truncate costate *Myophoria* attaining a length of about 12 mm. There are about 6-7 sharp radial ribs, the most posterior of which forms a marginal carina, delimiting a smooth concave posterior area. The remaining ribs are usually subequal and fairly evenly spaced, but occasionally the space between the marginal carina and the next rib may be rather wider than the remaining interspaces and occupied by a weak median radial thread. The ribs may be obscurely denticulate. Straight or slightly arched growth-threads are obscurely visible in the interspaces.

Remarks.—This form has fewer ribs than typical *M. chenopus* and the specimens figured by Bittner (1895, pl. xi. figs. 8-10) as intermediate between *M. inæquicostata* Klipstein and that species. It agrees closely with *M. chenopus* and the specimens in question both in shape and in the sharpness of the ribs, which are more rounded in typical *M. inæquicostata*. *M. myophoria* (Boettger) (Krumbeck, 1914, pl. xvii. figs. 13-17), from the Upper Trias of Sumatra, is also comparable, but has more ribs.

Distribution of M. chenopus.—Carnian of the northern and southern Alps and Hungary.

11. *Myophoricardium* cf. *lineatum* Wöhrmann.
(Pl. IV. fig. 11.)

Compare :—

Myophoricardium lineatum Bittner, 1895, pl. xiii. figs. 18-22.

Material.—Two specimens (L. 63480-1), one a right valve and the other a left one.

Description.—The better-preserved specimen, a slightly crushed mould, measures 10·7 mm. in length and 11·2 mm. in height, and is symmetrically trapezoidal in shape, except for the moderately prominent umbones, which are slightly anterior to median. The feebly convex sides converge nearly symmetrically from the ventral margin to the dorsal margins, with which they form high shoulder-like angles. A not very sharp carina runs from the umbo to the postero-ventral corner of the shell, while a corresponding but less distinct carina descends from the umbo on its anterior side. There is a clear impression of an elongate posterior lateral tooth, but the remaining details of the hinge are unascertainable.

Remarks.—The shape of this shell agrees more closely with that of *Myophoricardium lineatum* than of any species of *Myophoria*. A specimen from the Upper Trias of Tonkin, figured by Mansuy (1919, p. 11, pl. ii. fig. 7) as *M. cf. lineatum*, is more elongate than those now recorded, but possibly conspecific. There is also some resemblance in shape to the genus *Protocardia* (e. g., *P. contusa* Healey, 1908, pl. ix. figs. 22-29), but the posterior lateral tooth is more elongate than in that genus, and I can detect no posterior radial striation.

Distribution of M. lineatum.—Carnian of the northern and southern Alps, Hungary, Sicily, and Yun-nan (*Cowper Reed*). *M. cf. lineatum*, Muschelkalk of Trans-Jordan and Upper Trias of Tonkin.

REFERENCES.

- BITTNER, A. 1895. "Revision der Lamellibranchiaten von Set. Cassian." Abhandl. k.-k. geol. Reichsanst. vol. xviii. pt. i.
 COX, L. R. 1924. "A Triassic Fauna from the Jordan Valley." Ann. & Mag. Nat. Hist. (9) vol. xiv. pp. 52-96, pls. i., ii.
 —. 1932. "Further Notes on the Trans-Jordan Trias." *Ibid.* (10) vol. x. pp. 93-113, pl. vii.
 HEALEY, M. 1908. "The Fauna of the Napong Beds or the Rhaetic Beds of Upper Burma." Pal. Indien, n. ser. vol. ii. Mem. no. 4.
 KRUMBECK, L. 1913. "Obere Trias von Buru und Misol." 'Palaeontographica,' Suppl. iv. Abt. 2, Lief. 1.
 —. 1914. "Obere Trias von Sumatra." *Ibid.* Suppl. iv. Abt. 2, Lief. 3.
 —. 1923. "Brachiopoden, Lamellibranchiaten und Gastropoden aus der oberen Trias der Insel Seran (Mittel-Seran)." *Ibid.* Suppl. iv. Abt. 3, Lief. 4.
 MANSUY, H. 1908. "Contribution à la carte géologique de l'Indo-Chine.—Paléontologie." Gouv. Indo-Chine, Serv. des Mines.
 —. 1919. "Faunes triasiques et liasiques de Na Cham, Tonkin." Mém. Serv. géol. Indochine, vol. vi. fasc. 1.

- NEWTON, R. B. 1900. "On Marine Triassic Lamellibranchiata discovered in the Malay Peninsula." *Proc. Malac. Soc. London*, vol. iv. pp. 130-5, pl. xii.
- . 1923. "On Marine Triassic Shells from Singapore." *Ann. & Mag. Nat. Hist.* (9) xii. pp. 300-321, pl. ix.
- PATTE, E. 1926. "Etudes paléontologiques relatives à la géologie de l'est du Tonkin (Paléozoïque et Trias)." *Bull. Serv. géol. Indochine*, vol. xv. fasc. 1.

EXPLANATION OF PLATE IV.

(All figures, except 7 and 8, are of natural size.)

- Fig. 1. *Modiolus* cf. *raiblianus* Bittner (L. 63431).
- Fig. 2. *Modiolus raubensis* sp. n., holotype (L. 63430).
- Fig. 3. *Cassianella*? sp. (L. 63436).
- Fig. 4. *Hærnesia* cf. *bipartita* (Merian), rubber impression taken from natural mould (L. 63437).
- Fig. 5. *Hærnesia willbourni*, sp. n., holotype, rubber impression taken from natural mould (L. 63440).
- Fig. 6. *Gervillia* (*Langsonella*) *elongata* Mansuy (L. 63441).
- Figs. 7, 8. *Plicatula* (*Pseudoplacunopsis*) cf. *carinata* Healey, $\times 1\frac{1}{2}$ (L. 63445-6).
- Figs. 9, 10. *Grammatodon malayensis*, sp. n., holotype and paratype (L. 63425-6).
- Fig. 11. *Myophoricardium* cf. *lineatum* Wohrmann (L. 63480).
- Figs. 12-17. *Myophoria* cf. *harpa* (Münster), plasticine impressions (except fig. 17) taken from natural moulds (L. 63450-5).
- Figs. 18-23. *Myophoria* cf. *chenopus* Laube, plasticine impressions taken from natural moulds (L. 63465-70).

XIX.—On the Liassic Brachiopod Genera *Orthoidea* and *Orthotoma*. By HELEN M. MUIR-WOOD, D.Sc., F.G.S.
From the Department of Geology, British Museum
(Natural History).

In the course of research on the Zeilleriidae of the Lias it has been necessary to make a thorough examination of topotypes of *Orthoidea liasina*, the genotype of *Orthoidea*. Both genus and species were described by Friren in 1876 from the Middle Lias, *margaritatus* zone of Malroy, near Metz, and Montigny-les-Metz, France. There has been considerable difference of opinion about the affinities of this genus, and it has been placed in the families Orthidæ, Strophomenidæ, Terebratulidæ, and Zeilleriidae by various authors.

Friren (1876, p. 1, pl. i. figs. 1-6) describes his species as orthid-like, with the shell impunctate, and the shell-surface covered with numerous fine radiating striæ. The hinge-line is said to be straight, the larger valve alone having a triangular cardinal area, and no deltidium is

said to be developed. The beak is described as entire, and below it there is a large triangular delthyrium with a thickened margin, against which project two small ears from the right and left sides of the apex of the brachial valve. In the interior of the brachial valve no median septum is developed, but there is a median depression which appears as a ridge on internal casts. No brachial loop is preserved.

The absence of a median septum led Friren to believe, that no brachial loop could have been developed, and he consequently assigned his genus to the Strophomenidæ. Terquem examined Friren's specimens, and identified them as *Terebratula* [*Cincta*] *numismalis*, but did not publish any description of them. Friren, however, was not satisfied with this determination, although he admitted that the figures of a young specimen of *T. numismalis* given by Deslongchamps (1862, pl. xiii. figs. 1*a*, *b*, 2*a*, *b*) resembled his small shells from Malroy. This specimen of *T. numismalis* figured by Deslongchamps is 4 mm. in length, and has a convex pedicle valve and a flat brachial valve. Below the acute beak is an open triangular delthyrium. Deslongchamps stated that at a length of 7 or 8 mm. the beak was slightly truncated, and a rudimentary deltidium appeared at the base of the delthyrium. The deltidium is said to grow rapidly, and to be complete when the shell is 10–11 mm. in length. These growth-stages were unfortunately not figured by Deslongchamps, and Friren questioned the correctness of this description. In a series of growth-stages of *Orthoidea liasina*, Friren stated that the form of the beak and shape of the delthyrial opening did not vary in shells from 3–8 mm. in length. They could not, therefore, be identical with young shells of *T. numismalis*, as figured and described by Deslongchamps. In support of this, Friren remarked that adult shells of *T. numismalis* were not found in the *margaritatus* zone near Metz and that his specimens, 8 mm. long, appeared to be adult forms.

Haas and Petri (1882, p. 303, pl. xvii. figs. 12–14, 17) described and figured this species in their monograph of Jurassic Brachiopods of Alsace-Lorraine. Their figures are poor, and their description, beyond stating that the shell is punctate, is a repetition of that given by Friren.

In the synonymy they referred the young specimen of *T. numismalis* figured by Deslongchamps (1862, pl. xiii. figs. 1, 2) to Friren's species.

In 1884 Deslongchamps described various Brachiopod genera, and included some extremely caustic remarks about the work of Friren, and Haas and Petri. A series of early growth-stages of "*Terebratula*" *numismalis* was figured by Deslongchamps in this work, and he stated most emphatically that *Orthoidea liasina* was only an early growth-stage of *T. numismalis*.

Friren published further notes on *Orthoidea liasina* in 1887 (p. 73), and defended his species from Deslongchamps' attack, stating that he had sent specimens to Davidson, who regarded them as a remarkable form which he could not identify.

In spite of this second paper by Friren, Deslongchamps' opinion that *Orthoidea liasina* was only an early growth-stage of *Cincta numismalis*, and therefore a long-looped form, was accepted by Oehlert (1887), Hall and Clarke (1894), Marshall (1897), Schuchert (1913), and by Schuchert and Le Vene (1929).

Waagen (1884, p. 549), however, assigned the genus *Orthoidea* to the subfamily Orthinæ, and stated that the internal structure did not differ much from that of *Orthis*, but that the shell lacked radial striations. Rollier (1915, p. 46), on the other hand, placed *Orthoidea* with *Cadomella* in the Strophomenidæ, and in his discussion of the genus stated that no brachial loop was developed.

The only author who interpreted the genus *Orthoidea* correctly was Rau, who, in 1905, published descriptions of the Middle Lias Brachiopods of Swabia. In his description of *Orthotoma* sp., he pointed out the distinguishing characters of this form from *Orthoidea liasina*, which he obviously regarded as congeneric. Rau investigated the internal structure of *Orthotoma*, and proved it to be a Terebratulid having a short loop, no dorsal median septum, and an acute umbo, below which is an open triangular delthyrium. The delthyrium is bordered by narrow deltidial plates. The pedicle valve is convex and the brachial valve flattened, while the anterior commissure is sulcate.

Investigation by the author of the internal characters of species of *Orthotoma* has shown that they correspond

perfectly with those of *Orthoidea*, and there is no doubt that the two genera are synonymous.

With regard to the systematic position of the genus *Orthotoma* (= *Orthoidea*) it is obviously impossible to place this genus in the family Terebratulidæ, the genera of which have a truncated umbo, a circular foramen, and fused deltidial plates, nor is it possible to assign this genus to any other family of the Terebratuloids.

It is necessary, therefore, to establish a new family belonging to the superfamily Terebratulacea, Division A, Terebratuloids (Schuchert & Le Vene, 1929). For this new family the name Orthotomidæ is proposed.

Superfamily TEREBRATULACEA Waagen, 1883.

Division A. TEREBRATULOIDS.

Family Orthotomidæ, nov.

Terebratuloids without median septa or dental lamellæ. Loop short, free. Hypothyrid. Adult shells with triangular delthyrium bordered by jugate deltidial plates below acute umbo.

Range.—Lias.

Remarks.—This family includes at present only the genus *Orthotoma* (= *Orthoidea*), and its relation to the other families of the Terebratulacea is uncertain. An open triangular delthyrium, imperforate beak, and jugate deltidial plates have not been observed so far in the Terebratulidæ, but careful examination of young growth-stages will possibly establish their existence. In species of *Cincta*, belonging to the Zeilleriidæ, an open triangular delthyrium is seen in early growth-stages, but the deltidial plates are not jugate (figs. 7, 8). An imperforate beak is characteristic of the Stringocephalidæ, but the loop is of different form to that of *Orthotoma*.

Genus ORTHOTOMA Quenstedt.

Genotype.—*Terebratula heyseana* Quenstedt (non Dunker), 1869, pl. xlv. fig. 139 = *Orthotoma spinati* Rau 1905.

Orthotoma Quenstedt, 1869, pp. 315, 721.

Orthoidea Friren, 1876, p. 1.

Orthotoma Quenstedt : Dall, 1877, p. 53.

Orthoidea Friren : Dall, 1877, addenda p. 1; Haas & Petri, 1882, p. 303; Waagen, 1884, p. 519; Deslouchamps, 1884, pp. 171, 296; Friren, 1887, p. 73; Oehlert, 1887, p. 1318.

Eudesia (*Orthotoma*) Quenstedt : Oehlert, 1887, p. 1318.

Orthoidea Friren : Hall & Clarke, 1894, p. 887.

Orthotoma Quenstedt : Hall & Clarke, 1894, p. 885.

Eudesia (*Orthotoma*) Quenstedt : Schuchert, 1896, p. 332.

Orthoidea ? Friren : Schuchert, 1896, p. 332.

Orthotoma Quenstedt : Buckman, 1904, p. 389 ; Rau, 1905, p. 54 ; Schuchert, 1913, p. 406.

? *Orthoidea* Friren : Schuchert, 1913, p. 407.

Orthoidea Friren : Rollier, 1915, p. 46.

Orthotoma Quenstedt : Buckman, 1917, p. 96 ; Rollier, 1917, p. 179.

? *Orthoidea* Friren : Franceschi, 1921, p. 217.

Orthoidea Friren : Schuchert & Le Vene, 1929, p. 90.

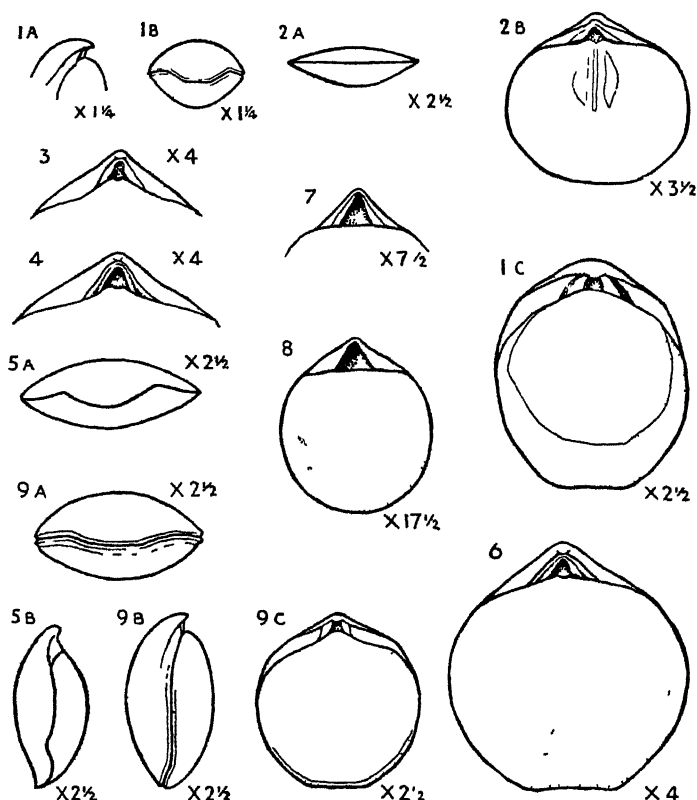
Orthotoma Quenstedt : Schuchert & Le Vene, 1929, p. 92.

Diagnosis.—Shell biconvex in neanic stage becoming plano-convex to sulco-convex, circular to elongate-oval in outline, anterior commissure rectimarginate to sulcate. Umbo acute, tapering, suberect to incurved. Hypothyrid. Beak-ridges angular, defining concave triangular interareas. Triangular delthyrium bordered by jugate deltidial plates. Cardinal process minute, projecting vertically as two small ears. Hinge-plates free, indistinguishable from inner socket-ridges. Loop terebratulid, extending for one-third of length of brachial valve. Dorsal adductor-scars trigonal in outline. Shell punctate.

Range.—Middle Lias, *margaritatus* and *spinatus* zones of Europe.

Species.—*Orthotoma liasina* (Friren) ; *O. quenstedti* S. S. Buckman (= *O. margaritatus* Rau) ; *O. solidorostris* Rau ; *O. spinatus* Rau ; *O. sp.* Rau ; ? *Orthoidea canavarii* Franceschi.

Discussion of Genotype.—The genus *Orthotoma* was defined by Quenstedt in 1869 (p. 315) in the middle of the description of the species *Terebratula heyseana* Dunker, and on p. 721 of the same work he said "*Orthotoma* . . . Zur Gruppe der *Terebr. Heyseana*." Quenstedt described more than one species as *T. heyseana*, and he was evidently aware that the forms he was describing might not be identical with Dunker's species, in which the beak-characters were insufficiently known. There, is, however, no doubt about the identity of the genus *Orthotoma* from Quenstedt's description (1869), but his figures of *T. heyseana*. on pl. xlv. figs. 139–142 represent three distinct congeneric species, none of which are *T. heyseana* Dunker. The specimen depicted as fig. 141 had already been figured by Quenstedt in 1852, pl. xxxvii. fig. 47, as *T. heyseana*.



Figs. 1 A-C.—*Orthotoma solidorostris* Rau. Lias δ oben, *spinatus* zone, Hechingen, Wurttemberg. B.M. [B. 90544].

Fig. 1 A.—Lateral view showing acute incurved umbo. $\times 1\frac{1}{4}$.

Fig. 1 B.—Anterior view of same specimen showing incipiently sulcate commissure. $\times 1\frac{1}{4}$.

Fig. 1 C.—Dorsal view of same specimen showing umbo incurved over jugate deltidial-plates. $\times 2\frac{1}{2}$.

Figs. 2 A, B.—*Orthotoma lasma* (Fröen). Middle Lias, *margaritatus* zone, Malroy, near Metz. B.M. [B. 90538].

Fig. 2 A.—Anterior view showing plane commissure. $\times 2\frac{1}{2}$.

Fig. 2 B.—Dorsal view of same specimen showing jugate deltidial plates. The adductor muscle-scars are seen through the test. $\times 3\frac{1}{2}$.

Fig. 3.—*Orthotoma quenstedti* S. S. Buckman. Middle Lias δ , *margaritatus* zone, Goldbach, Gmund, Wurttemberg. B.M. [B. 90541]. Dorsal view of umbonal region showing growth of deltidial plates medianly and decrease in size of delthyrium. $\times 4$.

Fig. 4.—*Orthotoma quenstedti* S. S. Buckman. Middle Lias δ , *margaritatus* zone, Salach, Wurttemberg. B.M. [B. 90546]. Dorsal

The specimens figured in 1852, pl. xxxvii. fig. 47, and in 1869, pl. xlv. fig. 139, represented Quenstedt's concept of the species *T. heyseana*, and fig. 139 was specially referred to in the description of the genus *Orthotoma*, and was apparently regarded as the typical form.

This insertion of *Orthotoma* with a hypothyrid beak in the middle of descriptions of species with epithyrid beaks led to considerable confusion in the interpretation of the genus.

The first author to quote a type for *Orthotoma* was Dall, who in 1877 mentioned it as a subgenus of *Terebratula* with "*Ter. heyseana*, Roemer, Verst. Nordl. Ool. 1836, p. 35, t. 12, f. 7," as type. As Roemer did not figure any specimen as *T. heyseana* this species cannot be accepted as genotype.

In 1894 (p. 885) Hall and Clarke mention *T. heyseana* Dunker as the type of *Orthotoma* without further comment, and the genus is placed with the Zeilleriids.

The next author to investigate the genus was S. S. Buckman, who, in 1904 (p. 389), stated erroneously that Quenstedt named *T. heyseana* Dunker as genotype of *Orthotoma*. As the form he figured was not Dunker's

view of umbonal region showing open triangular delthyrium and jugate deltidial plates having median sulcus. $\times 4$.

Figs. 5 A, B.—*Orthotoma quenstedti* S. S. Buckman. Middle Lias δ , Goldbach, Gmünd. B.M. [B. 90543].

Fig. 5 A.—Anterior view showing sulcate commissure. $\times 2\frac{1}{2}$.

Fig. 5 B.—Lateral view of same specimen. $\times 2\frac{1}{2}$.

Fig. 6.—*Orthotoma quenstedti* S. S. Buckman. Same horizon and locality. B.M. [B. 90542]. $\times 4$. Dorsal view showing slightly incurved umbo and deep median sinus.

Fig. 7.—*Cincta* sp. Young specimen. Lower Lias, *oxynoti* zone, Aston Magna, Glos. B.M. [B. 90540]. $\times 7\frac{1}{2}$. Dorsal view of umbonal region showing open triangular delthyrium, truncated umbo, and separate deltidial plates, figured for comparison with *Orthotoma*.

Fig. 8.—*Cincta* sp. Very young specimen. Same horizon and locality as fig. 7. B.M. [B. 90539]. $\times 17\frac{1}{2}$. Specimen showing open triangular delthyrium, straight hingo-line, and concave dorsal valve.

Figs. 9 A-C.—*Orthotoma spinati* Rau. Lias δ oben, *spinatus* zone, Wilfingen, Württemberg. B.M. [B. 69737].

Fig. 9 A.—Anterior view showing slightly sulcate commissure. $\times 2\frac{1}{2}$.

Fig. 9 B.—Lateral view of same specimen. $\times 2\frac{1}{2}$.

Fig. 9 C.—Dorsal view showing slightly incurved umbo. $\times 2\frac{1}{2}$.

All specimens preserved in British Museum
(Natural History) collections.

species, Buckman stated that *T. heyseana* Quenstedt (non Dunker) was the genotype of *Orthotoma*. The specimen figured by Quenstedt in 1852, pl. xxxvii. fig. 47, as *T. heyseana* was renamed *Orthotoma quenstedti* by Buckman, and this species was selected by him as genolectotype. Unfortunately, Buckman's diagnosis of the genus was incorrect, as he regarded it as a Zeilleriid and described the long-looped species *T. anglica* Oppel, *T. reclusa* Quenstedt, and *Orthotoma toarciensis* S. S. Buckman as belonging to *Orthotoma*.

Rau (1905) gave an excellent description of *Orthotoma*, and figured four new species, *O. sp.*, *O. margaritati*, *O. spinati*, and *O. solidorostris* from the Lias δ of Swabia. The name *O. margaritati* was proposed for Quenstedt's specimen figured as *T. heyseana* in 1852, pl. xxxvii. fig. 47, and for the three forms figured in 1869, pl. xlv. figs. 141, 142, and ? 138. Buckman had already proposed the name *O. quenstedti* for this species, and *O. margaritati* Rau, therefore, is synonymous with *O. quenstedti*. The name *O. spinati* was proposed by Rau for the specimen figured by Quenstedt as *T. heyseana* in 1869, pl. xlv. fig. 139. The more massive form figured as *T. heyseana* in 1869, pl. xlv. fig. 140, was renamed *Orthotoma solidorostris*. No mention of genotype was made by Rau.

When Rau's paper was published in 1905 Buckman realized that his diagnosis of *Orthotoma* in 1904 was incorrect, and in 1917 he rectified this, giving a new diagnosis as a Terebratulid genus, and he selected *Orthotoma spinati* Rau as genotype. He made no reference, however, to his selection of *O. quenstedti* as genotype in 1904.

In 1929 Schuchert and Le Vene, in their revision of the Brachiopoda genera, accepted Buckman's opinion of 1917, and stated "Genotype (S. d. B.[uckman]): *Terebratula heyseana* Quenstedt (non Dunker), 1868; Petref. pl. xlv. fig. 139 = *O. spinati* Rau, 1905, Brach. Mittl. Lias Schwabens, p. 54."

After careful consideration of Quenstedt's description and figures, and the work of subsequent authors on the genus *Orthotoma*, it is proposed to adopt the species *O. spinati* Rau, 1905, as genotype. There is considerable doubt from Quenstedt's drawings as to whether the specimen figured as *Terebratula heyseana* in 1852, pl. xxxvii. fig. 47, and refigured in 1869, pl. xlv. fig. 141, has a hypo-

thyrid beak. Quenstedt himself stated that it lacked the opening below the umbo, and that it appeared to have discrete deltidial plates. As this specimen is not preserved in the Quenstedt collection at Tübingen University, the specimen regarded as typical of *Orthotoma heyseana* by Quenstedt and renamed *O. spinati* by Rau is selected as genotype. The lectotype of this species is preserved at Tübingen.

Remarks.—Species of *Orthotoma* are readily distinguished by their hypothyril beak, triangular delthyrium, and jugate deltidial plates, as well as by their internal characters.

The name *Orthotoma* was given by Quenstedt to this genus on account of its straight hinge-line.

Dunker's species *T. heyseana* was described from the Belemniten-schichten [Lias γ] of Hainberg, Göttingen, Hannover. It was obtained, therefore, from a lower zone than species of *Orthotoma*, which only occur in the Lias δ = *margaritatus* and *spinatus* zones of the Middle Lias. The shell corresponds in general form with species of *Orthotoma*, but is broader than the specimens figured by Quenstedt. Examination of topotypes in the Mantell collection, British Museum (Nat. Hist.) [B. 90569–70] has shown that the shell has a long loop and a median septum in the brachial valve, and is, therefore, a Zeilleriid and distinct form *Orthotoma*. These specimens may be metatypes, as they have an original label in Latin with a reference to Dunker's paper in 'Palæontographica,' i., and they correspond very well with Dunker's original figures.

A specimen figured by Roemer in 1836 as *T. resupinata* Sowerby, from Hainberg, was identified by Quenstedt in 1852 as belonging to *T. heyseana* Dunker.

Further confusion about Dunker's species was caused by Oppel (1856, p. 304), who mentioned *T. bakeriæ* Dav. and *T. heyseana* Quenstedt, 1852, pl. xxxvii, fig. 47, in the synonymy of *T. heyseana* Dunker.

The small sulcate shells with epithyrid beak described by Deslongchamps in 1863 (pl. xxiv, figs. 1–5) as *T. (Waldheimia) heyseana* were redescribed in part by Quenstedt as *Terebratula reclusa*. The latter species was described erroneously by Buckman in 1904 as an *Orthotoma*.

Franceschi's species *O. canavarii* (1921, pl. i, fig. 2), from the Middle Lias of the Central Apennines, is doubt-

fully referred to *Orthotoma*. The species *Leptæna apenninica*, also described from the Middle Lias by Canavari (1884) and referred to the genus *Orthoidea* by Bittner in 1890 (p. 308), appears to have an epithyrid beak.

Rollier (1917, p. 179) gave a correct description of the genus *Orthotoma*, and separated it from *Terebratula*, placing it in a separate family, which is described as "Famille inconnue." He described the species "*Terebratula*" *heyseana* Dunker and *T. globulina* Dav. as belonging to *Orthotoma*, the former, however, is a Zeilleriid and the latter is a Terebratulid with an epithyrid umbo.

Buckman's diagnosis of this genus in 1917 (p. 96) does not refer to internal characters, but stated "morphogeny, biconvex to sulcate—liothyridina passing to *centronella* stage." This statement is open to criticism, since there is no proof that the loop in *Orthotoma* passes through a *centronella*-stage. The shell is certainly convex in early growth-stages and sulcate in later stages, but this cannot be taken as evidence of affinity with *Centronella*. The *centronella*-stage is an early stage of loop-development in many Terebratulids and in primitive Spiriferids.

Buckman pointed out that there are at least three homöomorphous stocks with sulcate anterior commissures in the Lias, (1) short-looped forms which are hypothyrid (*Orthotoma*), (2) short-looped forms which are not hypothyrid (? gen. nov.), (3) long-looped forms which are not hypothyrid (gen. nov.).

The following species have been incorrectly referred to the genus *Orthotoma* by various authors :—

Terebratula globulina Dav. Terebratulid.

— *bakeriæ* Dav. Terebratulid.

— *heyseana* Dunker. Zeilleriid.

— *reclusa* Quenstedt. Zeilleriid.

— *anglica* Oppel. Cineta.

Orthotoma toarciensis S. S. Buckman. Zeilleriid.

None of these species, with the exception of *T. anglica*, can be referred to existing genera, but the Zeilleriid forms will be examined and described in the near future by the author. Internal casts and transverse sections of specimens of *T. anglica* Oppel, from the Lower Inferior Oolite, show that this species belongs to the Liassic genus *Cincta*.

DESCRIPTION OF SPECIES.

Orthotoma liasina (Friren).

(Figs. 2 A, B, 10, 16.)

Orthoidea liasina Friren, 1876, p. 1, pl. i. figs. 1-6; Haas & Petri, 1882, p. 303, pl. xvii. figs. 12-14, 17; Friren, 1887, p. 73; Rau, 1905, p. 56; Rollier, 1915, p. 46.

Diagnosis.—*Orthotoma*, about 6 mm. long, 6 mm. wide, 2.5 mm. thick, circular in outline, plano-convex in all growth-stages. Anterior commissure incipiently sulcate. Lateral commissure vertical. Umbo sub-erect.

Type-specimen.—The specimen figured by Friren in 1876, pl. i. figs. 2-4, from the Middle Lias, *margaritatus* zone, Malroy, near Metz, is hereby selected as lectotype.

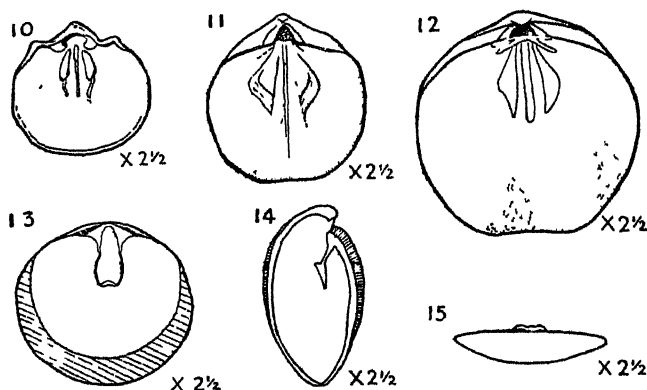
Horizon and Locality.—Middle Lias, *margaritatus* zone of Malroy, near Metz, on the banks of the Moselle, and of Montigny-les-Metz. Topotypes are preserved in the Davidson collection, British Museum (Nat. Hist.) [B. 90550-9, B. 90537-8, B. 90705]. One specimen in the Davidson collection from Vassy, ? Calvados, France [B. 6587].

Dimensions.—Specimen no. [B. 90550]. Maximum length 6.8 mm., maximum width 6.9 mm., maximum thickness 2.6 mm., or 1 : 1.01 : 0.38.

Description.—The hinge-line is straight and is slightly less wide than the maximum width of the shell. The pedicle valve is convex in all growth-stages, and the brachial valve flat or very slightly convex. The umbo is frequently imperfect and the acute apex missing. The beak-ridges are angular and the concave interareas are well demarcated. The narrow jugate deltidial plates are slightly elevated above the level of the interareas and border the triangular delthyrium. The two lobes of the cardinal process project beyond the anterior margin of the delthyrium as two small ears. The shell-surface is ornamented by very fine striae.

Internal casts preserved in limonite or iron pyrites show a narrow median ridge corresponding to a median cavity in the brachial valve, on each side of which are the dorsal adductor muscle-scars, which are triangular in outline, with the outer margin curved. The shape of the scars in the pedicle valve is somewhat obscure, but they are posteriorly placed. Traces of vascular sinuses are frequently seen in the brachial valve from the lateral

and anterior margins of the adductor scars (fig. 10). The cardinal process, hinge-plates, etc. (fig. 16), are similar in form to those described in *O. spinati*. The loop is usually poorly preserved.



- Fig. 10.—*Orthotoma liasina* (Friren). Middle Lias, *margaritatus* zone. Malroy, near Metz. B.M. [B. 90537]. $\times 2\frac{1}{2}$. Natural internal cast showing adductor muscle-scars and vascular sinuses. The ridge on the cast corresponds to a sulcus in the interior of the valve.
- Fig. 11.—*Orthotoma quenstedti* S. S. Buckman. Lias δ , *margaritatus* zone, Salach, Württemberg. B.M. [B. 90545]. $\times 2\frac{1}{2}$. Dorsal view of artificially prepared internal cast showing adductor muscle-scars and vascular sinuses.
- Fig. 12.—*Orthotoma solidorostris* Rau. Lias δ oben, *spinatus* zone, Ohmenhausen, Württemberg. B.M. [B. 90549]. $\times 2\frac{1}{2}$. Dorsal view of artificially prepared internal cast showing adductor muscle-scars.
- Fig. 13.—*Orthotoma spinati* Rau. Lias δ oben, *spinatus* zone, Hochingen, Württemberg. B.M. [B. 90678]. $\times 2\frac{1}{2}$. Specimen from which pedicle valve has been removed and brachial loop dissected out in dorsal valve. Cardinal process not preserved. Exterior of shell ruled.
- Fig. 14.—*Orthotoma spinati* Rau. Same horizon and locality as 13. B.M. [B. 90676]. $\times 2\frac{1}{2}$. Specimen ground longitudinally to show lateral view of brachial loop.
- Fig. 15.—*Orthotoma spinati* Rau. Same horizon and locality as fig. 13. B.M. [B. 90677]. $\times 2\frac{1}{2}$. Umbo of brachial valve showing two lobes of cardinal process projecting ventrally. These lobes appear at base of dolthyrium in fig. 11.

All specimens preserved in the British Museum
(Natural History) collections.

Remarks.—This small species is at present only known from the Middle Lias of three localities in France.

Friren (1876) figured two specimens of *Orthoidea* (= *Orthotoma*) *liasina*, one of which is an internal cast.

The specimen depicted as figs. 2-4, and selected as lectotype, was reproduced by Haas and Petri in 1882, pl. xvii, figs. 14 A, B.

Orthotoma quenstedti S. S. Buckman.
(Figs. 3, 4, 5 A, B, 6, 11, 17.)

Terebratula heyseana Dunker: Quenstedt, 1852, p. 471, pl. xxxvii. fig. 47.

Terebratula cornuta Sowerby: Quenstedt, 1856, p. 180, pl. xxii. figs. 19, 20.

Terebratula heyseana Dunker: Quenstedt, 1869, p. 314, pl. xlv. fig. 141.

Orthotoma quenstedti S. S. Buckman, 1904, p. 391.

Terebratula (Orthotoma) margaritatus Rau, 1905, p. 56, pl. iii. figs. 37-43; text-figs. 3 a-g.

? *Orthotoma amalihei* Rau, 1905, p. 83 (name only).

Orthotoma quenstedti S. S. Buckman, 1917, pp. 97, 234, pl. xx. fig. 35.

Orthotoma margaritatus Rau: S. S. Buckman, 1917, p. 97 (name only).

Orthotoma margaritata Rau: Rollier, 1917, p. 180.

Diagnosis.—*Orthotoma*, about 8 mm. long, 8 mm. wide, and 3 mm. thick, moderately biconvex in early growth-stages, becoming plano-convex to concavo-convex. Circular in outline. Anterior commissure sulcate. Lateral commissure slightly bowed. Umbo suberect.

Type-specimen.—Holotype, the specimen figured by Quenstedt in 1852, pl. xxxvii. fig. 47, as *Terebratula heyseana* from the Upper Lias of Hinterweiler, Württemberg. This specimen has not been identified in the Quenstedt Coll. in the Geological-Palæontological Institute of the University of Tübingen, Württemberg.

Horizon and Locality.—Middle Lias δ , *margaritatus* zone of Württemberg. Specimens are preserved in the British Museum (Nat. Hist.) from Salach [B. 90545-8]; and Goldbach, Gmünd [B. 90648-9, B. 90704, B. 90541-3].

Dimensions.—Brit. Mus. [B. 90546]. Maximum length 8.5 mm., maximum width 8.3 mm., maximum thickness 3.3 mm. or 1 : 0.97 : 0.38.

Description.—The hinge-line is slightly curved, and the maximum width occurs about midway between the posterior and anterior extremities. The pedicle valve is subcarinate umbonally, then becomes convex with the development of a low rounded median fold anteriorly. The brachial valve is slightly convex near the umbo, then flattens, and a median sinus, increasing in width and depth anteriorly, is developed about 4 mm. below the umbo. The beak-ridges are angular, and are traceable to the

postero-lateral slopes. The interareas are small and slightly concave, and are separated from the jugate deltidial plates by a sulcus.

Growth-lines are prominent on the anterior portion of the shell, and fine radial striae are frequently observed.

Internal Characters.—An artificially prepared internal cast showed the trigonal adductor muscle-scars of the brachial valve and vascular sinuses well preserved. The scars are separated by a narrow median ridge. Vascular sinuses are given off from the anterior and lateral extremities of the scars (fig. 11).

Transverse sections (fig. 17) showed similar internal characters to those described in *O. spinati*.

Remarks.—*Orthotoma quenstedti* is distinguished from *O. spinati* by the greater sulcation of the brachial valve and by its more erect and tapering umbo.

Buckman's species, *O. quenstedti*, with *Terebratulula heyseana* Quenstedt (non Dunker), 1852, pl. xxxvii. fig. 47, as holotype, is synonymous with *O. margaritati* described by Rau a year later (1905).

Buckman, in 1917 (p. 234, pl. xx. fig. 35), stated that Rau (1905) had figured a broad and narrow form as *O. margaritati*, but that the narrow form only could be called *O. margaritati* as the broad form had been described by Buckman in 1904 as *O. quenstedti*. As the "broad and narrow forms" alluded to by Buckman are only small variations of one species it is proposed to retain the name *O. quenstedti* for both forms. Buckman (1917, pl. xx. fig. 35) figured one of Rau's syntypes of *O. margaritati* from the Lias δ mitten, of Eislingen, Württemberg. The lectotype of *O. quenstedti* has unfortunately not been identified in the Quenstedt collection at Tübingen, and there is a distinct doubt as to whether Quenstedt's specimen is really an *Orthotoma*. It may therefore be necessary in the future to redefine Rau's species, and to assign *Orthotoma quenstedti* to the Zeilleriidae.

Rau described his species from the upper part of the *margaritatus* zone, Middle Lias δ , of Balingen and Gmünd, Württemberg, and gave excellent figures of this form. On p. 83 of the same work Rau referred to *Orthotoma amalthei* as occurring in the Lias δ mitten. No other reference is made to this species, and it appears to be quoted erroneously instead of *O. margaritati*.

Fig. 16.



Fig. 17.



Fig. 16.—*Orthotoma liasina* (Friren). Eleven transverse sections * through the umbones at distances of 0.1 mm. to 0.3 mm. apart, showing the shell somewhat imperfectly preserved in iron pyrites. Middle Lias, *margaritatus* zone, Malroy, Metz. B.M. [B. 90705]. $\times 5$.

Fig. 17.—*Orthotoma quenstedti* S. S. Buckman. Eleven successive transverse sections * through the umbones at distances of 0.1 mm. to 0.3 mm. apart. The cardinal process is seen in sections 3 and 4, and the slightly inclined hinge-plates in sections 5-8. The loop appears in sections 10 and 11. Lias δ , *margaritatus* zone, Goldbach, Gmünd, Württemberg. B.M. [B. 90704]. $\times 5$.

* A full description of the method employed and of the structures seen in the transverse sections is given by the author in *Philos. Trans. London*, ser. B, cccxiii. no. 505 (1934).

Quenstedt, in 1856 (pl. xxii. figs. 18-21), figured four small specimens as young examples of *Terebratula cornuta* from the Lias δ . Of these, figs. 19, 20 were referred by Rau (1905) to the species *Orthotoma margaritati* (= *O. quenstedti*).

The specimen figured by Quenstedt in 1852, pl. xxxvii. fig. 47, as *T. heyseana* is said by that author to be re-figured in 1869, pl. xlv. fig. 141. It is doubtful whether Quenstedt's specimen depicted as fig. 138 of pl. xlv. as *Terebratula heyseana* can be ascribed to the genus *Orthotoma*. Rothpletz (1886, p. 127) compared his species *Waldheimia frontensis* with *W. heyseana* Deslongchamps (non Dunker) [= "*Zeilleria*" *reclusa* Quenst.], and referred Quenstedt's specimen figured in 1869, pl. xlv. fig. 138, to Deslongchamps' species.

Orthotoma solidorostris Rau.

(Figs. 1 A-C, 12, 18.)

Terebratula cornuta Sowerby: Quenstedt, 1856, p. 180, pl. xxii. fig. 18.

Terebratula heyseana Dunker: Quenstedt, 1869, p. 314, pl. xlv. fig. 140.

Terebratula (Orthotoma) solidorostris Rau, 1905, p. 58, pl. iii. figs. 52-61.

Orthotoma solidorostris Rau: Buckman, 1917, p. 97, pl. xix. fig. 29; Rollier, 1917, p. 180.

Diagnosis.—*Orthotoma*, about 11 mm. long, 10 mm. wide, and 7 mm. thick, circular to elongate-oval in outline, biconvex-globose becoming plano-convex in gerontic stage. Anterior commissure incipiently sulcate. Lateral commissure flexuous. Umbo incurved, partially concealing delthyrium.

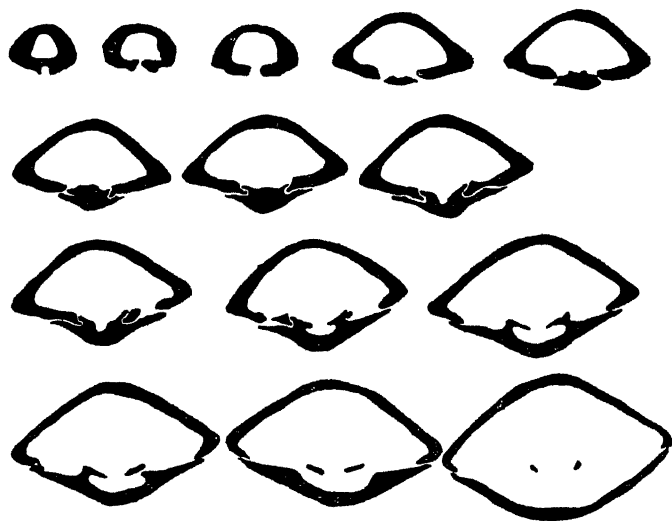
Type-specimen.—The specimen figured by Quenstedt in 1869, pl. xlv. fig. 140, as *Terebratula heyseana*, Lias δ oben, *Leptaena* Bed, is hereby selected as lectotype. This specimen is preserved in the Geological-Palæontological Institute of the University of Tübingen, Württemberg.

Horizon and Locality.—Middle Lias, *spinatus* zone = Lias δ oben, *Leptaenenschicht* of Württemberg. Specimens are preserved in the British Museum (Nat. Hist.) from Boll [B. 90647]; Eislingen [B. 90642, 90702]; Hechingen [B. 90640-41, B. 90544]; Ohmenhausen [B. 90549]; Wilfingen [B. 90643]; Zell [B. 90644-46].

Dimensions.—Lectotype. Maximum length 10.8 mm., maximum width 10.7 mm., maximum thickness 7.4 mm., or 1 : 0.99 : 0.68.

Description.—The hinge-line is gently curved, and the greatest width of the shell occurs at about one-third of the distance from posterior to anterior extremity. The pedicle valve is subcarinate posteriorly, becoming convex about 3 mm. below the umbo. The brachial valve is globose posteriorly, but flattens in the gerontic stage. The angular beak-ridges converge towards the shell-margin and disappear on the postero-lateral slopes. The

Fig. 18.



Orthotoma solidorostris Rau. Fourteen transverse sections through the umbones at distances of 0.1 to 0.3 mm. apart. The cardinal process is seen in sections 4-7, and the highly inclined hinge-plates in sections 8-12. The brachial loop appears as two dots in the last section, at a distance of 2 mm. from the first section. Lias δ , *spinatus* zone, Eislingen, Württemberg. B.M. [B. 90702]. $\times 3\frac{1}{2}$ approx.

jugate deltidial plates are demarcated from the inter-areas by a deep sulcus running parallel to the outer margin of each deltidial plate. The umbo is acute, tapering and incurved. Growth-lines are prominent anteriorly, and the shell is thickened along the anterior commissure. No radial striæ were observed.

Internal Characters.—Transverse sections of this species (fig. 18) show that the shell is thickened with callus

posteriorly in both valves. The cardinal process is medianly sulcate and short postero-anteriorly. The hinge-plates are scarcely differentiated from the inner socket-ridges and extend dorsally at an angle of about 25° to the horizontal.

The adductor muscle-scars of the brachial valve are trigonal in outline, with the inner margins parallel, and tapering to an acute extremity anteriorly. The scars are 4 mm. long in a brachial valve 10 mm. in length (fig. 12).

Remarks.—*Orthotoma solidorostris* is distinguished from *O. spinati* and *O. quenstedti* by its slightly larger dimensions, greater convexity of both valves, and more tapering and incurved umbo.

Rau (1905) figured this species from Wilfingen, Geislingen, and Balingen in Swabia, but he did not select a type.

The specimen figured by Quenstedt in 1856 (pl. xxii. fig. 18) as a young example of *Terebratulula cornuta* from the Lias δ was referred to the species *O. solidorostris* by Rau.

Examination of Quenstedt's specimen (the lectotype) has shown that it agrees perfectly in form and dimensions with the specimens figured by Rau from Swabia.

Orthotoma spinati Rau.
(Figs. 9 A-C, 13-15.)

Terebratulula heyseana Dunker : Quenstedt, 1869, p. 314, pl. xlv. fig. 139.

Terebratulula (Orthotoma) spinati Rau, 1905, p. 57, pl. iii. figs. 44-51 ; text-figs. 3 h-l.

Orthotoma spinati Rau : S. S. Buckman, 1917, p. 96, pl. xix. fig. 28.

Orthotoma spinata Rau : Rollier, 1917, p. 180.

Diagnosis.—*Orthotoma*, about 7.5 mm. long, 7 mm. wide, and 4 mm. thick, elongate-oval in outline, biconvex becoming plano-convex. Anterior commissure sulcate. Lateral commissure gently waved. Umbo tapering, slightly incurved.

Type-specimen.—The specimen figured by Quenstedt as *Terebratulula heyseana* in 1869, pl. xlv. fig. 139, from the upper Lias δ was selected as lectotype by S. S. Buckman in 1917. This specimen is preserved in the Quenstedt collection, Geological-Palæontological Institute of the University of Tübingen, Württemberg.

Horizon and Locality.—Middle Lias, *spinatus* zone= Upper Lias δ , Leptaenenschicht of Württemberg. Specimens are preserved in the British Museum (Nat. Hist.) from Zell (B. 90650–51); Wilflingen (Rau coll.) [B. 69737]; Hechingen [B. 90676–8].

Dimensions.—Lectotype. Maximum length 9.7 mm., maximum width 8 mm., maximum thickness 4.9 mm., or 1 : 0.82 : 0.50.

Description.—The hinge-line is gently curved and is approximately equal to the greatest width of the shell. The brachial valve is moderately convex posteriorly, but is flattened about 3 mm. from the umbo. The pedicle valve is subcarinate posteriorly, but becomes convex in the ephebic stage.

Growth-lines are prominent anteriorly, but no radial striae were observed.

Internal Characters.—Investigation of the interior of the brachial valve has shown that in a specimen having a brachial valve 7.5 mm. in length the loop was 2.5 mm. in length. In a brachial valve 7.6 mm. in length the loop was found to be 2.3 mm. in length. The loop is Terebratulid in outline with the curved descending branches flattened dorso-ventrally, and appearing thread-like in dorsal view. The transverse band is broad and projects ventrally slightly above the level of the descending branches.

The longitudinal sections parallel to the plane of symmetry of the shell show that the crura supporting the loop are 1.25 mm. in length (fig. 14).

The cardinal process is narrow postero-anteriorly and projects posteriorly as two small lobes into the cavity of the pedicle valve. The hinge-plates are fused with the inner socket-ridges and are inclined dorsally at an angle of about 33° to the horizontal. The teeth are small and tapering, and deeply inserted into the narrow sockets. The crural bases project anteriorly in the same plane as the hinge-plates. Transverse sections showed a similar internal structure to that figured in *O. quenstedti* and *O. solidorostris*.

Remarks.—*O. spinati* is distinguished from *O. solidorostris*, by its less globose shell and less incurved beak, and from *O. quenstedti* by the non-development of a sulcus in its brachial valve.

Rau (1905) described this species from the "Costaten schicht" and Leptaenenschicht of Wilflingen, Swabia, and figured the loop and an enlargement of the jugate deltidial plates and beak of the brachial valve in this species.

Buckman (1917) figured much enlarged beaks of specimens of *Orthotoma spinati* and *O. solidorostris* for comparison with the beaks of *Zeilleria*, *Epithyris*, *Homæorhynchia*, etc.

SUMMARY.

Investigation of the internal, as well as of the external, characters of *Orthoidea liasina* Friren, the genotype of *Orthoidea* (1876), has shown that it belongs to the Terebratuloids, and not to the Terebratellids, as has been generally accepted. The internal structure as well as the external characters, hypothyril beak-ridges, jugate deltidial plates, etc., of this genus have proved to be similar to those of *Orthotoma* Quenstedt (1869), and *Orthoidea* is therefore synonymous with *Orthotoma*. The affinities of this genus have been discussed and a new family, Orthotomidæ, belonging to the superfamily Terebratulacea, division Terebratuloids, has been created. The genotype of *Orthotoma* has been discussed and the four species, *Orthotoma liasina* Friren, *O. quenstedti* S. S. Buckman, *O. solidorostris*, and *O. spinati* Rau, have been diagnosed and figured. Transverse sections of *Orthotoma liasina*, *O. quenstedti*, *O. solidorostris*, and *O. spinati* show the similarity in the internal structure, and artificially prepared internal casts of three of the species show similarly placed dorsal adductor muscle-scars.

I am much indebted to Professor Baron von Huene for the loan of two of the specimens figured by Quenstedt as *Terebratula heyseana* in 1869. The remaining specimens figured by Quenstedt as *T. heyseana* cannot at present be found in the Geological-Palæontological Institute of the University of Tübingen, Württemberg.

REFERENCES.

- BITTNER, A. 1890. "Brachiopoden der alpinen Trias." Abh. geol. Reichsanst. Wien, xiv. p. 308.
BUCKMAN, S. S. 1904. "Jurassic Brachiopoda." Ann. & Mag. Nat. Hist. (7) xiv. pp. 389-397.

- BUCKMAN, S. S. 1917. "The Brachiopoda of the Namyau Beds, Northern Shan States, Burma." *Palæont. Indica*, n.s. iii. no. 2, pp. 96-98, pls. xix. xx.
- CANAVARI, M. 1884. "Contribuzione III alla Conoscenza dei Brachiopodi degli Strati a *Terebratula aspasia* Mgh. nell' Appennino centrale." *Atti Soc. tosc. sc. nat. Pisa*, Mem. vi. fasc. I, pp. 70-110.
- DALL, W. H. 1877. "Index to the Names which have been applied to the Subdivisions of the Class Brachiopoda." *Bull. U.S. Nat. Mus.* viii. pp. 1-88.
- DAVIDSON, T. "Monograph of British Fossil Brachiopoda." *Palæont. Soc.* 1851-55, vol. i.; 1874-82, vol. iv.
- DESLONGCHAMPS, E. 1862-85. '*Paléontologie française. Terrain Jurassique.*—vi. *Brachiopodes.*' Paris.
- . 1884. "Notes sur les modifications à apporter à la Classification des Terebratulidæ." *Bull. Soc. Linn. Normandie, Caen*, (3) viii. pp. 161-350, pl. xiii.
- DUNKER, W. 1847. "Ueber einige neue Versteinerungen aus verschiedenen Gebirgsformationen." '*palæontographica*,' Stuttgart, i. pp. 128-133, pl. xviii.
- FRANCESCOI, R. 1921. "Descrizione di alcuni Brachiopodi del Lias medio nell' Appennino centrale." *Atti Soc. tosc. sc. nat. Pisa*, xxxiii. pp. 217-219, pl. i.
- FRÉREN, A. 1876. "Mélanges paléontologiques. Art. i. *Orthoidea, Straparolus, Ammonites* . . . du Lias moyen." *Bul. Soc. Hist. nat. Metz*, (2) xiv. pp. 1-22, pl. i.
- . 1887. "Mélanges paléontologiques. Art. ii. no. iii. Histoire de deux Fossiles du Lias moyen." *Bul. Soc. Hist. Nat. Metz*, (2) xvii. pp. 73-76.
- HAAS, H., & PETRI, C. 1882. "Die Brachiopoden der Juraformation von Elsass-Lothringen." *Abh. geol. Spez. Karto Els.-Loth.* ii. heft 2, pp. 161-320, 18 pls.
- HALL, J., & CLARKE, J. M. 1894. "An Introduction to the Study of the Brachiopoda." *Ann. Rep. State Geol. N. York*, xi. for 1891.
- MARSHALL, J. W. D. 1897. "Notes on British Jurassic Brachiopoda." *Proc. Bristol Nat. Soc.* viii. pt. 2, pp. 232-257.
- MUIR-WOOD, H. M. 1934. "On the Internal Structure of some Mesozoic Brachiopoda." *Philos. Trans. London*, B, ccxxiii. no. 505, pp. 511-567.
- OEHLERT, D. P. 1887. "Appendice, Brachiopodes," in Fischer, P., *Manuel de Conchyliologie [1880-1887]*. Paris.
- OPPEL, A. 1854. "Der mittlere Lias Schwabens." *Württ. naturwiss. Jahresh. Stuttgart*, x. 1, p. 109.
- . 1856. "Die Juraformation Englands, Frankreichs und des südwestlichen Deutschlands." *Württ. naturwiss. Jahresh. Stuttgart*, xii. p. 304.
- QUENSTEDT, F. A. 1851-52. '*Handbuch der Petrefaktenkunde.*' Tübingen.
- . 1856-58. '*Der Jura.*' Tübingen.
- . 1868-71. '*Petrefaktenkunde Deutschlands. Abt. 1, ii.—Die Brachiopoden.*' Tübingen.
- RAU, K. 1905. "Die Brachiopoden des mittleren Lias Schwabens mit Ausschluss der Spiriferinen." *Geol. paläont. Abh. Berlin* x. N.F. vi. heft 5, pp. 1-94, pls. i.-iv.
- ROEMER, F. A. 1836. '*Die Versteinerungen des norddeutschen Oolithe-Gebirges.*' Hanover.
- ROLLIER, L. 1915-1919. "Synopsis des Spirobranches (Brachiopodes) Jurassiques Celto-Souabos." *Mém. Soc. Pal. Suisse*, xli. pp. 1-422.

- ROTHEPLETZ, A. 1886. "Geologisch-palæontologische Monographie der Vilser Alpen, mit besonderer Berücksichtigung der Brachiopoden-systematik." 'Palæontographica,' Stuttgart, xxxiii. p. 127.
- SCHUCHERT, C. 1896. "Brachiopoda," in Zittel-Eastman, Text-book of Paleontology, 1st edition, i. p. 332. London.
- . 1913. "Brachiopoda," in Zittel-Eastman, Text-book of Paleontology, 2nd edition, i. pp. 406, 407. London.
- , & LE VENE, C. M. 1929. 'Brachiopoda. Fossilium Catalogus.—I. Animalia,' pt. 42.
- WAAGEN, W. 1884. 'Brachiopoda, in Salt Rango Fossils.—I. Productus Limestone Fossils,' iv. fasc. 3, p. 549; Paleont. indica, ser. xiii.

XX.—*Insects of the New Hebrides : Chrysomelidæ.*

By G. E. BRYANT, F.R.E.S.

AMONG the Coleoptera collected by Miss L. E. Cheesman in the New Hebrides in 1929–30 there are 570 specimens of Chrysomelidæ, representing 38 species, of which I now describe 14 new species.

The various subfamilies are represented as follows :—

Cryptocephalinæ.....	1 species.
Eumolpinæ	16 „
Chrysomelinæ	1 „
Halticinæ	11 „
Galerucinae	7 „
Hispinæ	2 „

No species of the subfamilies Criocerinae, Clytrinae, and Cassidinae were met with. The number of new species is greater than 14, as there are many very obscure Eumolpinæ, represented in some cases by single specimens, which I have not dealt with. In all probability 23 out of the 38 species are new. The types of the new species are in the British Museum.

Ten of the previously described species occur in neighbouring groups of islands—Fiji, Samoa, and New Caledonia.

Haltica corrusca Er. and *Aulacophora similis* Ol. have a wide distribution.

CRYPTOCEPHALINÆ.

Pycnophthalma ænea, sp. n.

Upperside metallic bronze-green; underside pitch-black, clothed with short grey pubescence. Legs and

antennæ flavous, the six apical joints of antennæ tinged with fuscous.

Length 2 mm.

Head deeply embedded in prothorax, eyes very large, touching each other on upper side of head. Labrum fulvous, behind the insertion of antennæ somewhat finely punctured. Antennæ flavous, the six apical joints tinged with fuscous, extending just beyond the base of prothorax, the two basal joints the stoutest, the first nearly twice as long as the second, the third longer than the second, the third to the eleventh about equal to each other.

Prothorax metallic bronze-green, feebly punctured, contracted in front, the sides compressed near the middle, with two impressed oblique lines in front of the middle; the basal part opposite the scutellum produced into a lobe, acutely pointed, more shining, and impunctate. Scutellum oblong, very small.

Elytra metallic bronze-green, striate-punctate, slightly carinate at sides between the striæ. Underside pitch-black, clothed with very short scattered pubescence.

New Hebrides: Malekula, iii. 1930 (*Miss L. E. Cheesman*), 1 example.

Allied to *P. tutuilana* Mlk. from Samoa, but may be distinguished by the sides of the prothorax compressed, with two oblique impressions.

EUMOLPINÆ.

METACHROMINI.

Vitibia formosa Baly, Trans. Ent. Soc. Lond. 1877, p. 40 (*Rhyparida*); Fairm. Ann. Soc. Ent. Fr. (6) i. 1881, p. 488. New Hebrides.

TYPOPHORINI.

Eurydemus grandis Baly, Journ. of Ent. i. 1861, p. 287 (*Rhyparida*); Journ. Linn. Soc. Lond. xiv. 1878, p. 259. New Caledonia. *E. insignis* Chap. Gen. Coll. x. 1874, p. 334, note 1 (Australia), t. 122. f. 4; Fairm. Ann. Soc. Ent. Fr. (6) i. 1881, p. 482 (Fiji).

New Hebrides: Malekula, i. 1930 (*L. E. Cheesman*), 1 example, on foliage; clearing in bush at 500 ft.

ENDOCEPHALINI.

Colaspoides sp.

New Hebrides : Santo, viii.-ix. 1929 (*L. E. Cheesman*),
1 example, by beating ; 10 miles inland at 2000 ft.

NODOSTOMINI.

Nodostoma sp.

New Hebrides : Banks Is., Vanua Lava, x. 1929 (*L. E. Cheesman*) ; in blossom, *Ipomea* sp.

Rhyparida buxtoni, sp. n.

Oblong, convex, subnitidous, fulvous, the six terminal joints of antennæ tinged with fuscous, the median portion and sides of prothorax, the margins and suture of the elytra, and underside fuscous.

Length 4 mm.

Head flavous; the clypeus tinged with fuscous, the vertex feebly punctured, a few larger and scattered punctures on the clypeus, a short median longitudinal impression between the eyes. Antennæ filiform, extending to the middle of elytra, fulvous, the six terminal joints tinged with fuscous. Prothorax transverse, fulvous, the median portion fuscous, with the exception of a fulvous spot at the base in front of scutellum, the side-margins narrowly fuscous, the sides rounded and constricted in front, the anterior and posterior angles slightly produced, finely and not closely punctured. Scutellum fuscous, subtriangular, impunctate. Elytra fulvous, with side margins and suture narrowly fuscous, strongly punctate-striate, the punctures becoming feebler towards the apex. Legs fulvous, clothed with pubescence. Underside fuscous with scattered pubescence and feebly punctured.

New Hebrides : Mai Is., 12. vii. 1928 (*Dr. Buxton*), 1 example. Tanna, ix. 1925 (*Dr. Buxton*), 2 examples. Vila, vi. 1925 (*Dr. Buxton*), 4 examples. Tanna, x. 1930 (*L. E. Cheesman*), 2 examples, by sweeping clearing central bush. Malekula, Ounua, iii., iv. 1929 (*L. E. Cheesman*), 7 examples, on low plant on the reef. Banks Is., Paku, x. 1929 (*L. E. Cheesman*), 2 examples, at light.

Allied to *R. flava* Clk. from Australia, but differs in the fuscous markings and the prothorax having punctures.

In the long series before me the majority are entirely fulvous, but it is undoubtedly a variable species.

Demotina difficilis, sp. n.

Oblong, subcylindrical, plum-brown, with legs and antennæ flavous, clothed with close adpressed yellowish scales; the elytra with darker transverse wavy bands, strongly punctate-striate.

Length 2.5–3 mm.

Head plum-brown, vertex clothed with short yellowish scales; clypeus strongly punctured, clothed with a few long, fine, greyish hairs. Antennæ long and slender, extending well beyond the base of elytra, the first two joints thick, first longer than second, the fourth the longest, a little longer than the third or fifth, the seven terminal joints about equal to each other. Prothorax plum-brown, sides slightly darker and closely punctured; median portion clothed with short adpressed yellowish scales, sides with longer yellowish pubescence, slightly rounded, widest behind middle, constricted at base. Scutellum deep plum-brown, impunctate, with a few scattered yellowish scales. Elytra oblong, rounded at apex, plum-brown, with a dark patch near each shoulder, a median transverse wavy band, another between this and the apex, and a dark patch near the apex clothed with short adpressed yellowish scales and scattered dark hairs, strongly punctate-striate. Legs flavous, front femora armed with a small tooth. Underside with the sternum fulvous, clothed with ashy pubescence, sides of metasternum strongly punctured. Abdomen flavous and glabrous with scattered grey pubescence, apical ventral segment with a few strong punctures.

New Hebrides: Erromanga, ix. 1930 (*L. E. Cheesman*), 7 examples, stream bank by sweeping ferns. Santo, viii.–ix. 1930 (*L. E. Cheesman*), 14 examples. Malekula, iii.–v. 1929 (*L. E. Cheesman*), 14 examples, river bank by sweeping.

Allied to *D. veitchi* Bryant from Fiji Is., but differs in the pattern and paler legs. This is a very variable species, as in some the pattern almost disappears.

Demotina flavipes, sp. n.

Oblong, subcylindrical; head and prothorax plum-brown, clothed with short adpressed whitish scales and hairs; elytra deep fuscous, clothed with short golden scales and two whitish patches near the middle, the apex

paler with two pale lines near the suture; legs and six basal joints of the antennæ flavous; the sternum fulvous and the ventral segments of the abdomen flavous, clothed with scattered grey and golden pubescence.

Length 3 mm.

Head plum-brown, feebly punctured and clothed with adpressed golden hairs, a well-marked longitudinal median carina extending from the middle of the head to the base; the clypeus clothed with long fine hairs. Antennæ long and slender, extending a little beyond the middle of elytra, the six basal joints flavous, and the five terminal fuscous, the first and second more swollen than the others, the second the shortest. Prothorax plum-brown, side-margins darker, median portion clothed with short adpressed whitish scales, the sides with longer adpressed pubescence, closely punctured, slightly transverse, with the sides rounded and contracted in front, widest behind the middle. Scutellum fuscous-brown, subquadrate, with a few hair-like scales. Elytra deep fuscous, the basal margin slightly fulvous, strongly punctate-striate, clothed with very short adpressed golden scales and longer scattered pubescence, a white patch of thicker scales on each elytron before the middle near the suture; apex paler, with two pale lines on the apical third next to the suture. Legs flavous; front femora with a small tooth. Sternum fulvous, clothed with whitish adpressed pubescence; ventral segments of abdomen flavous, with shorter pubescence.

New Hebrides: Erromanga, viii. 1930 (*L. E. Cheesman*), 2 ♀♀.

Allied to *D. vitiensis* Bryant from Fiji Is., but the elytra much darker and the pattern different.

CHRYSOMELINÆ.

Plagioder a fulvicollis, sp. n.

Body ovate, strongly convex; head, prothorax, legs, and underside fulvous; elytra metallic purple.

Length 6 mm.

Head broad, fulvous, impunctate, front marked with a strong V-shaped impression. Antennæ with the five basal joints fulvous, the six terminal fuscous, clothed with very short grey pubescence; not extending to the middle of elytra, the first joint thick and club-shaped,

twice as long as the second, the third nearly twice as long as second, the fourth shorter than the third and about equal to the fifth, the fifth and following joints thickened and more opaque. Prothorax fulvous, impunctate, twice as broad as long, the front margin much narrower than the posterior, the sides oblique. Scutellum triangular, impunctate, fuscous, with median portion fulvous. Elytra metallic purple, strongly convex, broadened behind the middle, narrowed towards the apex; humerus strongly raised, finely but not strongly punctured, the punctures fewer along the side-margins; margins with a blue tinge. Legs fulvous; underside fulvous.

New Hebrides: Malekula, Ounua, iii. 1929 (*L. E. Cheesman*), 1 example, at light.

Allied to *P. violaceipennis* Bryant from Fiji Is., but much smaller and less brilliantly coloured, and the puncturation stronger.

HALTICINÆ.

Febra ovata, sp. n.

Oval convex, flavous, with sides of prothorax and elytra bluish green, the colour not extending to the side-margins or apex of the elytra; antennæ flavous, the apical portion of the six terminal joints fuscous; head, prothorax, and scutellum impunctate, except for a row of scattered punctures along the base of prothorax. Elytra punctate-striate.

Length 4 mm.

Head flavous, impunctate, clypeus toothed, a median longitudinal impression behind the insertion of antennæ, not reaching to base of head. Antennæ long, extending beyond the apex of elytra, flavous, with the apical half of the six terminal joints fuscous, the first joint very long, expanding into a club, the second very short, less than half the length of the first, the third and fourth long and slender, equal to each other and about as long as the first, fifth slightly shorter, sixth to tenth about equal to each other, and slightly shorter than fifth, eleventh longer, with the apical third contracted and tapering. Prothorax transverse, the sides margined and slightly contracted in front, impunctate, except for a scattered row of punctures along base, flavous with sides bluish green, the colour not extending to the

side-margins. Scutellum flavous, impunctate, broadest at the base. Elytra flavous, with sides bluish green, not extending to the side-margins or apex, strongly punctate-striate, the punctures feebler towards the apex. Legs and underside entirely flavous.

New Hebrides : Banks Is., Vanua Lava, x. 1929 (*L. E. Cheesman*), 2 examples, beaten from *Angiopteris evecta*. Mt. Tane Lava, 3000 ft.

Allied to *F. varioloidea* Fairm. from Fiji, but may be distinguished by the impunctate head, and the prothorax only having a row of punctures along the base, and all the femora flavous.

Licyllus viridipennis, sp. n.

Testaceous. Hind portion of the head, the eight terminal joints of the antennæ, and the tarsi piceous; elytra metallic bronze-green.

Length 3-4 mm.

Head with the base piceous, the front testaceous, impunctate, a longitudinal median impression between the insertion of the antennæ not extending to the base. Eyes entire and prominent. Antennæ long, extending well beyond the middle of elytra, the three basal joints slightly testaceous and tinged with fuscous, the eight terminal joints piceous, the first two stouter than the remainder, the first as long as the second, the third a little longer than the first, the fourth about equal to the third, the seven terminal joints about equal to each other, each a little shorter than the fourth. Prothorax testaceous, very transverse, sides rounded at middle, a strong tubercle in front of the posterior angles, which are obliquely shaped behind, the surface almost impunctate, with a few scattered punctures along the front margin, a deep transverse groove across the disk, not extending to the sides. Scutellum subtriangular, testaceous, impunctate. Elytra metallic bronze-green, finely and rugosely punctured, somewhat deeply impressed below the shoulders, widened below the middle and rounded at the apex. Legs and underside testaceous; the tarsi and apical portion of the tibiæ tinged with piceous; the ventral segments about equal to each other.

New Hebrides : Malekula, Malua Bay, vi. 1929 (*L. E. Cheesman*). Erromanga, ix. 1930, 8 examples.

Differs from *L. albicollis* F.=*L. splendidus* Jac. in having only the hind portion of the head piceous, the scutellum not black, the elytra entirely metallic bronze-green without any trace of the brilliant reddish-cupreous colour, and the hind femora not black.

Manobia costata, sp. n.

Elongate-ovate, fulvous; the seven terminal joints of antennæ fuscous; base of the prothorax strongly punctured; elytra with green-metallic tinge, strongly punctate-striate and costate.

Length 2 mm.

Head impunctate, fulvous, obliquely grooved above the insertion of antennæ, a small median longitudinal impression between the eyes; antennæ extending just beyond the base of the elytra, fulvous, the seven terminal joints fuscous, the second joint as wide as the first, but one-half shorter, the third to the sixth about equal to each other, but more slender than the second, the five terminal joints thickened. Prothorax fulvous with slight metallic tinge, a little broader than long, sides straight, anterior angles oblique, and the hind angles produced into a small tubercle, impunctate with the exception of the basal portion, which is slightly depressed and strongly and irregularly punctured. Scutellum transverse, fulvous, impunctate. Elytra fulvous, with a strong greenish-metallic tinge, with the exception of the suture and apex, which are a shade paler, the base distinctly raised, the punctured striæ very distinct, the sides with three or four distinct costæ branching from below the shoulders. Legs and underside fulvous, shining, the ventral segments of the abdomen with a few scattered punctures, the first segment the longest, about as long as the three following together.

New Hebrides: Malekula, i. 1930 (*L. E. Cheesman*), 17 examples, by sweeping central forest. Banks Is., Vanua Lava, vi. 1929 (*L. E. Cheesman*), 1 example. Santo, viii.-ix. 1929 (*L. E. Cheesman*), 2 examples, sea-level by beating.

Allied to *M. dimidiaticornis* Jac. from Sumatra, but differs in its more elongate shape and the very distinct costate elytra.

Aphthona cheesmani, sp. n.

Subovate, fulvous, shining; antennæ with the seven terminal joints, hind femora, and suture of the elytra fuscous.

Length 2 mm.

Head fulvous, slightly darker at the base, shining, impunctate, carinate between the antennæ. Antennæ extending to the middle of elytra, the four basal joints fulvous, the seven terminal fuscous, the first joint stouter than the others and nearly as long as the second and third together, the second much shorter than the third, the third about equal to the fourth, the fifth a little longer than the fourth or sixth, the sixth to tenth about equal, the eleventh longer and tapering at apex. Prothorax fulvous, shining and impunctate, slightly transverse. Scutellum fulvous, impunctate, subtriangular. Elytra ovate, fulvous, with the suture tinged with fuscous, shining and very closely and finely punctured. Legs fulvous, clothed with short, fine, golden pubescence; the hind femora fuscous. Underside fulvous, ventral segments of abdomen feebly punctured.

New Hebrides: Malekula, Ounua, iii.-iv. 1929. Banks Is. Vanua Lava, xi. 1929 (*L. E. Cheesman*), 18 examples.

Allied to *A. veitchi* Bryant from Fiji, but differs in having the suture fuscous, its more shining appearance, and the puncturation of the elytra much finer.

Aphthona erromangana, sp. n.

Subovate; basal joints of antennæ, head, prothorax, and legs fulvous. Elytra bronze, meso- and metasternum and abdomen black.

Length 2.50 mm.

Head fulvous, shining, impunctate, longitudinally carinate in front from between the base of the antennæ. Antennæ extending to about the middle of the elytra, the six basal joints fulvous, the remaining terminal joints tinged with fuscous, the two basal joints the stoutest, the second joint a little shorter than the first and third, the fifth the longest, the six terminal joints about equal to each other. Prothorax fulvous, shining, impunctate, the sides nearly straight, feebly margined, anterior angles obliquely truncate. Scutellum fulvous, triangular,

impunctate. Elytra oblong, rounded at apex, metallic-bronze, very feebly punctate-striate. Legs fulvous, clothed with short golden pubescence. Underside with the prosternum fulvous, the meso- and metasternum and ventral segments of abdomen black, finely but feebly punctured.

New Hebrides : Erromanga, viii. 1930 (*L. E. Cheesman*), 9 examples, by beating bank of stream.

Allied to no species in this region, but somewhat allied to *A. collaris* Baly, from Shanghai, but differs in the colour of elytra being bronze and less strongly punctate-striate and the hind femora not black.

Crepidodera cœruleoviolacea, sp. n.

Subelongate, convex, black ; antennæ and palpi flavous ; elytra metallic purple-blue.

Length 3 mm.

Head with the vertex black, shining, and impunctate ; front with a strong longitudinal carina, which is confluent at its apex with the front. Eyes round and prominent. Antennæ flavous, with the three apical joints tinged with fuscous, extending well beyond the base of elytra, the first joint longer and stouter than the second, the second joint the shortest, the remainder about equal to each other. Prothorax black, shining, transverse, about one-half broader than long, sides parallel, anterior angles obliquely truncate, hind angles acute, the basal transverse groove well defined. Scutellum triangular, black, impunctate. Elytra metallic purple-blue, broader than the prothorax, oblong, convex, slightly tapering to the apex, slightly depressed near the base, and along the basal margin five small foveæ, regularly but not strongly punctate-striate. Legs fuscous, with the basal half of all the tibiæ tinged with fulvous (in some specimens the legs are more flavous, probably an immature state). Underside black and shining.

New Hebrides : Malekula, i. 1930 (*L. E. Cheesman*), 17 examples, on foliage 3 miles inland. Santo, viii. 1929 (*L. E. Cheesman*), 4 examples.

Allied to *C. dimidiata* Baly, from ? Australia and Fiji, but differs in the head and prothorax being black, the antennæ paler, and the elytra less brilliant and bluer.

Nesohaltica atra, sp. n.

Oblong, shining, black; antennæ fulvous, with the two apical joints fuscous; legs pitch-brown, with the tarsi fulvous.

Length 2 mm.

Head shining black, the vertex impunctate, a transverse impressed line behind the interocular space, a short median longitudinal impression extending from the insertion of antennæ to the transverse line. Antennæ not quite extending to the middle of elytra, the nine basal joints fulvous, the two apical joints fuscous, the first joint long and slightly club-shaped, about half as long as the first, the third, fourth, and fifth more slender and about equal to each other, the sixth and seventh slightly thicker and about equal to each other, the eighth to the tenth shorter and thicker, the eleventh slightly longer and bluntly pointed. Prothorax black, shining, transverse, finely and sparingly punctured; sides slightly rounded and margined; anterior angles obliquely truncate. Scutellum black, impunctate, triangular. Elytra black, shining, more strongly and closely punctured than the prothorax; sides parallel and rounded at the apex. Legs pitch-brown with the tarsi fulvous. Underside black, shining.

New Hebrides: Erromanga, vii. 1930 (*L. E. Cheesman*), 2 examples, small gully 3 miles inland, 700 ft. by beating; ix. 1930 (*L. E. Cheesman*), 2 examples.

Allied to *N. nigra* Mlk., from Samoa, but differs in its shining black appearance, the much finer puncturation, and its smaller size.

The two specimens taken by Miss Cheesman in July appear to be slightly immature, as they have a much browner appearance, with the antennæ and legs flavous, the puncturation of elytra appears stronger than in the type, and they may be distinct.

Psylliodes novæcaledoniæ Baly, Trans. Ent. Soc. Lond. 1876, p. 600. New Caledonia.

New Hebrides: Malekula, Ounua, Feb. 1929, April 1929 (*L. E. Cheesman*), 69 examples by sweeping.

This species described by Baly from New Caledonia is represented by the unique type in the British Museum. This large series collected by Miss Cheesman varies in size from 2-3 mm., and the colour from green-blue to

bronze, but I think undoubtedly belong to one species, and agree well with the type; some have the front and middle femora dark, which is not the case in the type.

Haltica corrusca Er. Arch. f. Natur. viii. (1) 1842, p. 235.
Tasmania. Fiji.

New Hebrides: Banks Is., Vanua Lava, x. 1929 (*L. E. Cheesman*), 1 example. Aneityum, x. 1930 (*L. E. Cheesman*), 15 examples. Santo, viii. 1929 (*L. E. Cheesman*), 9 examples.

Phyllotreta blackburni Bryant, Ann. & Mag. Nat. Hist. (9) xv. p. 596. Fiji Is.

New Hebrides: Malekula, iv. 1930 (*L. E. Cheesman*), 2 examples.

GALERUCINÆ.

Aulacophora fulvimargo, sp. n.

Oblong, slightly broadened behind, fulvous; antennæ, tibie, and tarsi more or less fuscous; a fuscous patch on the head and prothorax; elytra bronze-brown, with a metallic tinge.

Length 6-7 mm.

Head fulvous, vertex with a fuscous patch at the base not extending to the eyes, finely reticulate, practically impunctate, interocular space with a transverse impression, intersected by a short longitudinal median impression starting from the insertion of the antennæ, a strong longitudinal carina extending from the base of the antennæ to the labrum. Eyes prominent. Antennæ long, filiform, extending just beyond the middle of the elytra, the two basal joints fulvous, the remainder fuscous, clothed with pale pubescence, the first joint long and club-shaped, about three times as long as the second, the third about equal to the first in length, the fourth to the terminal all about equal. Prothorax fulvous, the central portion fuscous, and the side-margins very narrowly fuscous, transverse, slightly constricted from behind the middle, and, behind the anterior angle, almost rectangular, side-margins reflexed, surface reticulate, with a few scattered punctures, a strong postmedian transverse depression; scutellum triangular, with the apex rounded, fulvous, impunctate; elytra metallic bronze-

brown, with the side-margins and suture very narrowly fulvous ♂ (♀ with the shoulders and apex of the elytra more broadly fulvous), finely shagreened, and somewhat closely punctured; legs fulvous, the tibiæ with the apical two-thirds and tarsi fuscous, clothed with golden pubescence. Underside entirely fulvous, clothed with long but not very close pubescence, the apical ventral segment strongly notched in the ♂.

New Hebrides: Malekula, i. 4. 1930 (*L. E. Cheesman*), 17 examples, on foliage, 500 ft. Tanna, x. 1930 (*L. E. Cheesman*), 1 example.

The specimen from Tanna differs in the head and side-margins of the prothorax being fulvous, the sutural margin expands in the centre, forming a triangular fulvous patch, and the elytra have a greenish tinge.

Allied to *A. nigrobrunnea* Mlk. from Samoa, but differs in its less nitid appearance, colour not black, and no trace of ribbing in the elytra.

Monolepta cheesmani, sp. n.

Oblong, fulvous; the elytra shining black; metasternum and apical joints of antennæ tinged with fuscous.

Length 2.5–3 mm.

Head fulvous, the basal half smooth and shining, the frontal more rugose, the clypeus and labrum with very fine golden pubescence, a transverse interocular groove, a narrow longitudinal impression in front of its middle. Antennæ fulvous, long and filiform, extending beyond the middle of the elytra, the first joint long, equal to second and third combined, the second and third about equal to each other, the fourth as long as first, the fifth a very little shorter than the fourth, the remainder each about equal to the fifth, the three terminal joints tinged with fuscous. Prothorax fulvous, about as long as broad, shining, very finely and feebly punctured, sides very slightly rounded and feebly contracted at base. Scutellum black, triangular, impunctate. Elytra black, shining, finely punctured, dilated posteriorly. Legs fulvous, the middle and hind tibiæ slightly curved, clothed with fine golden pubescence, the basal joint of the hind tarsi slightly longer than the rest combined. Underside fulvous, the metasternum tinged with fuscous, with a few scattered punctures and fine golden pubescence, the ventral seg-

ments of abdomen about equal to each other, the apical segment in the ♂ with a median fovea.

New Hebrides : Erromanga, viii. 1930 (*L. E. Cheesman*), 20 examples. Tanna, x. 1930 (*L. E. Cheesman*), 2 examples, by sweeping and beating.

Allied to *M. abaceta* Lea from N.S. Wales, but differs in the prothorax being much less transverse, the elytra more finely punctured, legs and antennæ a clearer colour, with only the apical joints of the antennæ slightly fuscous.

Aulacophora similis Ol. Ent. vi. 1808, p. 624, t. 2, f. 23 ;
Wse. Deutsch. Ent. Zeitsch. 1892, p. 393. Sanda Is.

New Hebrides : Malekula, Ounua, Feb. 1929 (*L. E. Cheesman*), 7 examples, clearing 3 miles inland, 1500 ft. Aneityum, xi. 1930 (*L. E. Cheesman*), 4 examples. Tanna, x. 1930 (*L. E. Cheesman*), 4 examples ; ix. 1925 (*Dr. P. A. Buxton*), 2 examples ; Tongoa Is., 13. vii. 1928 (*Dr. P. A. Buxton*), 1 example, on *Euphorbia* sp.

Aulacophora quadripartita Fairm. Journ. Mus. Godeffr. xiv. 1879, p. 113 (Micko Is.) ; Ann. Soc. Ent. Belg. xxvii. 1883, p. 56.

New Hebrides : Erromanga, viii. 1930 (*L. E. Cheesman*), 1 example. Santo Is., Hog Harbour, viii. 1925 (*Dr. P. A. Buxton*), 1 example.

Aulacophora quadrimaculata F. Mant. Ins. i. p. 75, no. iii. (Oceania).

Aulacophora austrocaledonica Montr. Ant. Soc. Ent. Fr. 1861, p. 211.

New Hebrides : Malekula, Ounua, ii.-iv. 1929 (*L. E. Cheesman*), 9 examples. Santo Is. : Big Bay, viii. 1925 (*Dr. P. A. Buxton*), 3 examples. Pentacost Is., 21. vi. 25 (*Dr. P. A. Buxton*), 1 example.

Plesistia brunnea Mlk., Insects of Samoa, 1929, pt. iv. fasc. 3, p. 199 (Samoa, Fiji).

New Hebrides, Malekula, Ounua, ii.-iv. 1929 (*L. E. C.*), 5 examples, on tree-trunk. Bush, inland and at light.

Monolepta semiviolacea Fauv. Bull. Soc. Linn. Normandie, vii. 1862, p. 169, t. 10 *bis*, ff. 74, 75 (New Caledonia).

New Hebrides : Tanna, ix. 1930, 5 examples. Malekula, iv. 1930, 2 examples. N.E. Malekula, vi. 1929, 18 examples. Erromanga, vii. 1930, 1 example. Santo, viii. 1929, 3 examples (*L. E. Cheesman*).

HISPINÆ.

CRYPTONYCHINI.

Brontispa froggatti Sharp, Proc. Linn. Soc. N.S. Wales, 1093 (1904), p. 924; Wse. Deutsch. Ent. Zeitsch. 1905, p. 299; Gest. Ann. Mus. Civ. Gen. 1905, p. 357. New Pomerania.

New Hebrides : Malekula, v. 1930 (*L. E. Cheesman*), 3 examples.

PROMECOTHECINI.

Promecotheca opacicollis Gestro, Ann. Mus. Civ. Gen. 1897, p. 121. New Hebrides.

New Hebrides : N.E. Malekula, vi. 1929 (*L. E. Cheesman*), 1 example. Malekula, Ounua Lava, ii. 1929 (*L. E. Cheesman*), 12 examples. Banks Is., Vanua Lava, x. 1929 (*L. E. Cheesman*), 2 examples. Epi Island (*Dr. P. A. Buxton*), 6 examples. Santo Island (*Dr. P. A. Buxton*), 8 examples, on coconut-palm.

XXI.—*On the Dates of Publication of Motschulsky (V. de), 'Etudes entomologiques,' I.-XI., 1853-1862.* By FRANCIS J. GRIFFIN, A.L.A., Registrar, Royal Entomological Society of London.

THERE has been uncertainty as to the dates of publication of 'Motschulsky's Etudes' for a long time, and, moreover, confusion has been caused by the fact that the Title-pages to the parts are dated a year later than the date at the head of p. 1 of each part.

I have been asked by the Editor of the new 'Nomenclator Zoologicus,' now in active preparation, to assist in determining the exact dates of publication, and having found that each part was recorded on its receipt as a gift to the Library of the "Société impériale des Naturalistes de Moscou" from the author—himself a Russian—

I hereby place this information on record for the use of Entomologists :—

Part no.	Pp.	Date on Title-page.	Date of receipt at " Soc. imp. Nat. Moscou " as recorded in its 'Bulletin.'
1	1-80	1853	29. x. 1853.
2	1-56	1854	18. xi. 1854.
3	1-69	1854	18. xi. 1854.
4	1-84	1855	28. xii. 1855.
5	1-88	1856	24. i. 1857.
6	1-112	1857	24. iv. 1858.
7	1-192	1858	18. xii. 1858.
8	1-187	1859	21. iv. 1860.
9	1-41	1860	12. x. 1861.
10	1-24	1861	11. x. 1862.
11	1-55	1862	13. xii. 1862.

XXII.—Some Parasitic Worms from the British Cameroons.

By H. A. BAYLIS, M.A., D.Sc., Department of Zoology,
British Museum (Natural History).

THE parasites recorded in this paper were collected by Mr. Ivan T. Sanderson in the course of the Percy Sladen Trust Expedition to the British Cameroons, 1932-1933. The collection included three new species of Nematodes, the type-specimens of which will be deposited in the British Museum (Natural History).

TREMATODES.

Family Paramphistomidæ.

Chiorchis fabaceus (Dies., 1838).

This form was obtained in large numbers from the intestine of a manatee (*Manatus senegalensis*) at Ekuri, Obubra Division, Southern Nigeria. The species, which occurs also in *Manatus exunguis* and *M. latirostris*, has been recorded previously from *M. senegalensis* in the Belgian Congo (Stunkard, 1929 ; Price, 1932).

CESTODES.

Family Anoplocephalidæ.

Inermicapsifer hyracis (Rud., 1808).

Specimens which are assigned to this species were obtained from a hyrax (*Procavia dorsalis*) at Tinta, Assumbo, Mamfe Division, Cameroons.

Inermicapsifer sp.

A few specimens of an undetermined species of this genus occurred together with the last-mentioned form in *Procavia dorsalis*.

NEMATODES.

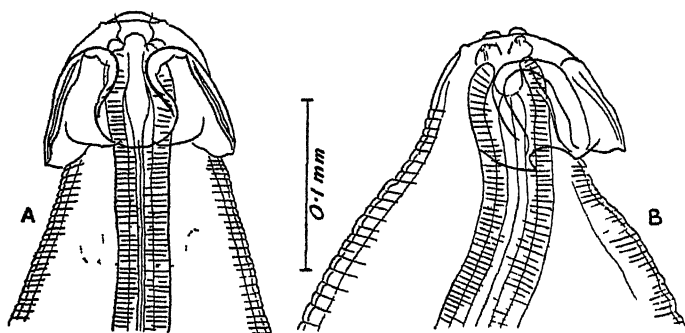
Family Oxyuridæ.

Syphacia obubra, sp. n.

(Figs. 1-3.)

This form occurred in flying squirrels (*Anomalurus fraseri*) at Nko, Obubra Division, Southern Nigeria, and at Bashauo, Mamfe Division, Cameroons. The specimens

Fig. 1.



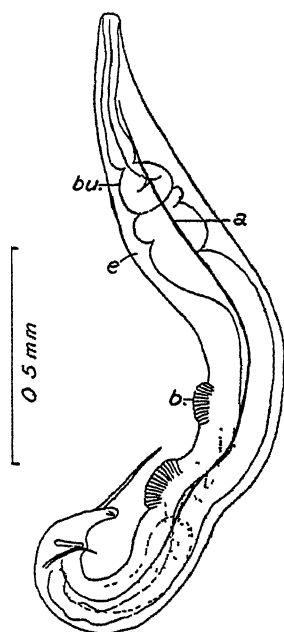
Syphacia obubra, sp. n. Anterior end of female.

A, dorsal view, B, lateral view.

from the former locality include several males and are taken as the types. Those from the second locality are in a less good general state of preservation, and consist of females only. They are, however, more extended, and enable certain features to be more readily observed. The description which follows is therefore partly based on them. A third set of female specimens, in very poor condition, was obtained from *Anomalurus beecrofti* at Eshobi, Mamfe Division, but these may possibly represent a different species. Perhaps as a result of their macerated condition, the oesophagus is considerably longer (0.8-0.9 mm.) in these specimens.

The male measures 2-2.35 mm. in length and 0.16-0.22 mm. in maximum thickness, the female 3.7-5.2 mm. and 0.33-0.53 mm. respectively. The anterior end, in the female only (fig. 1), bears a remarkable dorsal cuticular "frill," which somewhat resembles the structure described in the genus *Acanthoxyurus* by Sandground (1928) and by Mönnig (1931). In *Acanthoxyurus*, however, one or two

Fig. 2.



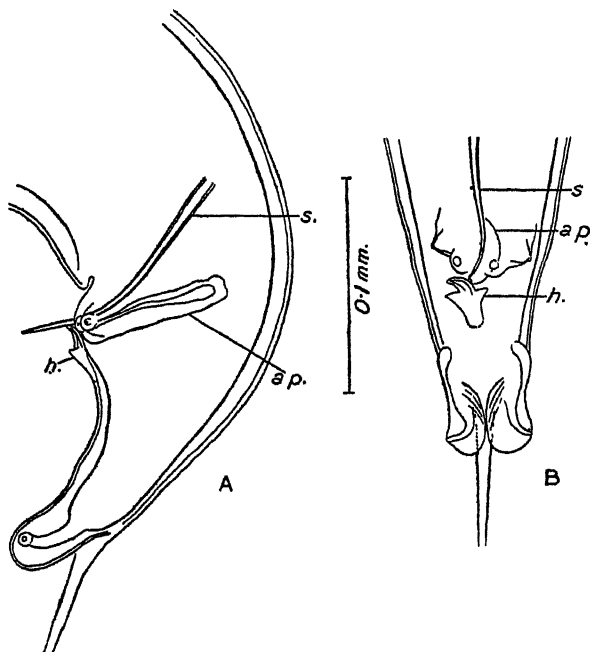
Syphacia obnuba, sp. n. Male, lateral view.

a., lateral ala; b., anterior ventral boss;
bu., oesophageal bulb; e., excretory pore.

pairs of backwardly-directed, subdorsal "chitinized spines" (Sandground) or "tusks" (Mönnig) project freely from the "frill." In the present species, although there is frequently (especially in lateral view) an appearance as if such spines were present, this appearance seems to be produced by two thickened horseshoe-shaped folds in the cuticle of the "frill," and not by actual spines. As in

Acanthoxyurus, the anterior end of the female is usually curved dorsally. There are no lateral or subdorsal cuticular lappets on the neck, behind the "frill," as described in *Acanthoxyurus*. The male (fig. 2), as already stated, is without a cephalic frill. It is a typical *Syphacia*, and resembles *S. pallaryi* (Seurat, 1915), *S. pearsei* Baylis, 1928, and *S. paraxeri* Sandground, 1933, in having only two, not three, ventral bosses.

Fig. 3.



Syphacia obubra, sp. n. Posterior end of male.

A, lateral view; B, ventral view.

a.p., accessory piece; h., hook-like structure; s., spicule.
(The scale applies to both figures.)

The transverse cuticular striations, in the male, are for the most part at intervals of about $3-4\mu$. On the ventral bosses there are transverse ridges $8-10\mu$ apart, and the striations on the ventral surface of the body for some distance behind the posterior boss are $6-10\mu$ apart. The surface of the cuticle in this region is tessellated. In the female the striations are at intervals which attain

a maximum of about $20\ \mu$ in the region between the vulva and anus. In the prevulvar region they are much closer together. In both sexes slight lateral alæ begin somewhat in front of the middle of the oesophageal region, and extend throughout the greater part of the body. In the male they disappear at about the level of the cloacal opening. In the female they extend beyond the anus on to the tail.

The mouth is surrounded by a circle of small papillæ (probably six). The lips are not distinct, but are apparently fused to enclose a small buccal cavity, which is continuous with a short pharynx, or anterior portion of the oesophagus. Measured from the extremity of the head and including the posterior bulb, the oesophagus measures 0.4–0.5 mm. in length in the male and 0.6–0.75 mm. in the female. There is a slight prebulbar swelling. The cuticular lining of the oesophagus, for the greater part of its length, shows fine transverse striations. The bulb measures 0.09–0.11 mm. in length and 0.1–0.11 mm. in width in the male; in the female these measurements are 0.13–0.18 mm. and 0.15–0.19 mm. respectively. Cervical glands, as described by Sandground in *Acanthoxyurus anomaluri*, were not seen. The nerve-ring is situated at about 0.09 mm. from the anterior extremity in the male, and at about 0.1–0.14 mm. in the female. The excretory pore is usually considerably behind the oesophageal bulb in the male, its distance from the anterior end varying between 0.4 and 0.7 mm. In the female it is also usually postoesophageal, but occasionally lies a little in front of the bulb. Its distance from the anterior end is 0.45–0.8 mm.

The tail of the male (fig. 3) measures 0.25–0.28 mm. in length, including a slender, tapering terminal filament which may be nearly 0.2 mm. long. The three pairs of caudal papillæ usual in *Syphacia* are present, but in lateral view (fig. 3 A) the more median of the two preanal pairs is often difficult to see, being at about the same level as the outer pair. The postanal papillæ are situated on the outer surfaces of a pair of very large and prominent processes at the base of the caudal filament. On the posterior lip of the cloacal aperture there is, as in some other species of *Syphacia*, a curious cuticular structure in the form of a flattened hook or spur (fig. 3 A & B, h.),

slightly curved ventrally towards the tip. While in other species in which it has been observed this spur appears to be simple, in the present species it bears a pair of pointed lateral processes. The spicule is tapering and pointed and measures about 0.12–0.14 mm. in length. The accessory piece is massive and about 0.07 mm. long. Of the two ventral bosses the posterior appears to be always the larger.

The tail of the female tapers to a slender point and measures 0.5–0.65 mm. in length. The vulva is situated at a distance of 1.2–2.1 mm. from the anterior end of the body. The vagina, which is muscular and measures about 0.22–0.4 mm. in length and 0.07–0.1 mm. in thickness, runs forward from the vulva. In this respect the species differs from typical species of *Syphacia*, but resembles *Acanthoxyurus*. The common trunk of the uterus turns posteriorly almost immediately from its junction with the vagina, and runs back with an almost straight course. The details of the female genital tubes are difficult to make out in gravid females, but the careful examination of young females showed that there is not a single ovarian tube, as is stated to be the case in *Acanthoxyurus*, but two such tubes, which are connected with the posterior end of the common trunk of the uterus, and turn forward immediately to run, parallel to each other, on either side of it. The general arrangement of the female genital apparatus is therefore typical. The examination of young females further showed that impregnation takes place before the development of the ovarian tubes, when the uterus is merely a relatively short, blind sac serving as a receptaculum seminis. A mass of cement is deposited over the vulva and would probably prevent any subsequent copulation.

The eggs are less elongate than in typical species of *Syphacia*, but have, as usual, one flattened surface, by which they frequently adhere together in pairs. They measure 0.06–0.07 mm. $\times$ 0.026–0.032 mm.

Family Strongylidae.

Theileriana denticulata, sp. n.

(Figs. 4–7.)

Host.—Hyrax (*Procavia dorsalis*) ; intestine.

Locality.—Tinta, Assumbo, Mamfe Division, Cameroons.

Of this species three males and eight females were collected. While bearing a close resemblance to the genotype, *T. brachylaima* (v. Linst., 1901) Mönnig, 1924,

Fig. 4.

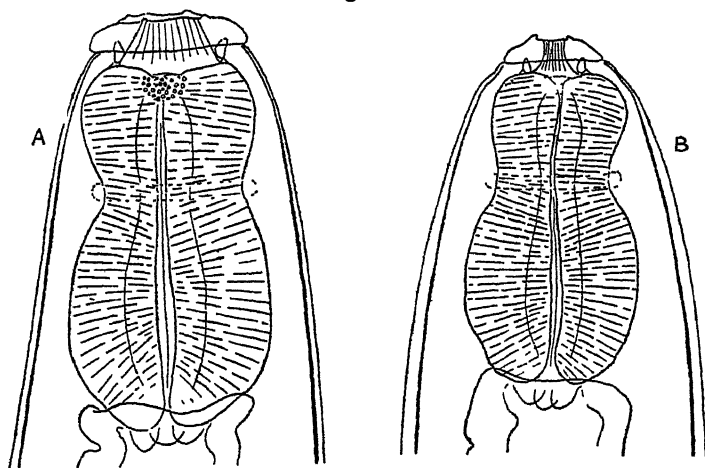
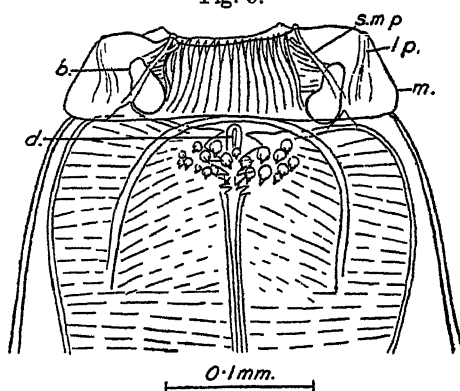


Fig. 5.



Theileriana denticulata, sp. n.

Fig. 4.—Anterior end, lateral view. A, male; B, female.

Fig. 5.—Anterior end of male; dorsal view. *b.*, buccal capsule; *d.*, process on which dorsal oesophageal gland opens; *l.p.*, lateral papilla; *m.*, mouth-collar; *s.m.p.*, submedian papilla.

it is a much smaller form, and differs in a number of morphological details. There is a remarkable sexual

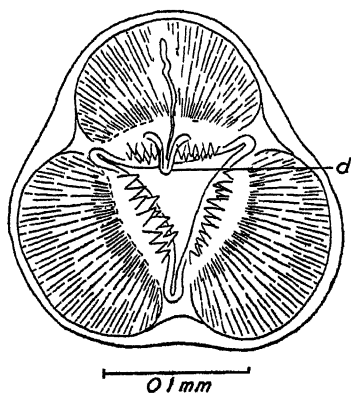
dimorphism in the characters of the anterior end of the worm, and had not the specimens of the two sexes occurred together in the same individual host (in which they were the only Nematodes found), they would certainly have been described as different species. One must, however, assume for the present that the differences are merely secondary sexual characters.

The male measures 6.5–9 mm. in length and 0.51–0.65 mm. in maximum thickness, the female 7.5–9.5 mm. and 0.75 mm. respectively. The cuticle has coarse and very irregular transverse striations. The intervals between these measure up to about 20μ in the male and 35μ in the female. The mouth collar is fairly well developed in the male (figs. 4 A & 5), where it measures 0.2–0.21 mm. in diameter and 0.04–0.06 mm. in depth. In the female (fig. 4 B) it is of only about half these dimensions (diameter 0.1–0.13 mm., depth 0.02–0.03 mm.), and is much more flattened. The buccal capsule is a thick, shallow, chitinous ring, measuring, in the male, about 0.13–0.15 mm. in outside diameter and about 0.04 mm. in depth. In the female this structure again is little more than half as large as in the male (diameter about 0.07–0.09 mm., depth about 0.02 mm.). The elements of the leaf-crown originate at the base of the capsule, and their points, which appear to be simple, just project beyond the mouth-opening. In the male there are about 40 elements, in the female only 25.

The cephalic papillæ are similar to those of *T. brachylaima*, except that the terminations of the submedian papillæ are not very prominent. The pulp of each submedian papilla appears to give off a small inner branch near its distal end, as described by Mönnig (1924) for *T. brachylaima*. The œsophagus (fig. 4) is relatively very short and almost hourglass-shaped, being divided into two unequal portions by a constriction, where it is surrounded by the nerve-ring. The absolute length of the œsophagus, in the male, is 0.45–0.51 mm., and its maximum width 0.22–0.31 mm. In the female the corresponding measurements are smaller (length 0.33–0.41 mm., width 0.17–0.23 mm.). Measured from the anterior extremity, the length of the œsophagus is 0.52–0.58 mm. in the male and 0.36–0.45 mm. in the female. The anterior portion of the œsophagus, or œsophageal funnel (figs. 4,

5, 6), is lined on its three sides with cuticular teeth. These are relatively large and sharply pointed in the male, and make a formidable-looking armature. In the female they are reduced to small nodules*. The duct of the dorsal œsophageal gland ends in a blunt process (figs. 5 & 6, *d.*), which projects from the dorsal wall of the œsophageal funnel anteriorly.

The nerve-ring is situated at 0.23–0.26 mm. from the anterior extremity in the male, and at 0.14–0.19 mm. in the female. The cervical papillæ are very small and bristle-like, and are situated behind the œsophagus, at



Thelohanania denticulata, sp. n. Œsophagus of male, optical transverse section through the œsophageal funnel

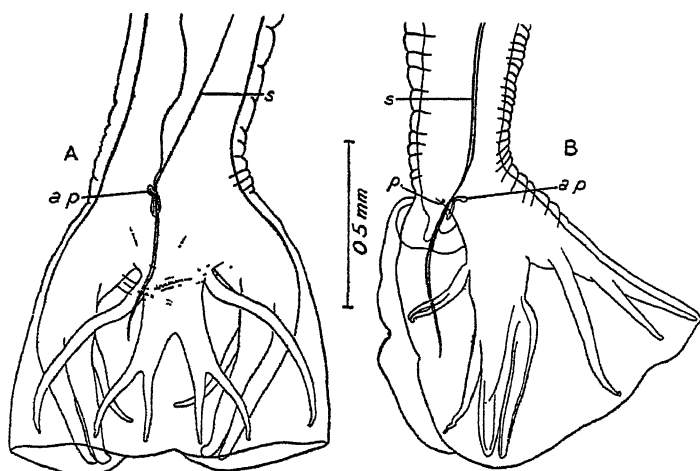
d process on which dorsal œsophageal gland opens.

about 0.62 mm. from the anterior end in the male and 0.68 mm. in the female. In the latter the excretory pore lies a little in front of the cervical papillæ (at 0.62–0.63 mm. from the anterior end). In the male the pore was not seen.

* On examining specimens of *T. brachylaema*, from *Proctavia capensis*, kindly lent by Prof. D. B. Blacklock, of the Liverpool School of Tropical Medicine, and by Prof. H. O. Monnig, of Onderstepoort, South Africa, it was found that in that species also the œsophageal funnel is lined with small teeth. These do not, however, attain the size of those of the male of *T. denticulata*, and do not appear to have been seen by any of the authors who have described the species.

The bursa of the male (fig. 7) has no distinct dorsal lobe. The terminal branches of the dorsal ray are of almost equal length, the outer branches being very slightly longer than the inner (not shorter, as in *T. brachylaima*). There is no accessory branch on the inner branches, as described by Turner (1921) for *T. brachylaima*, nor were such accessory branches seen in *T. brachylaima* itself. The arrangement of the rays is similar to that in *T. brachylaima*. The ventral rays are small, and the prebursal papillæ very small. The genital cone is relatively short. The spicules are very slender and measure about 1·6–

Fig. 7.



Theileriana denticulata, sp. n. Posterior end of male.

A, dorsal view, B, lateral view.

a.p., accessory piece; p., prebursal papilla; s., spicules.

1·7 mm. in length. There is a saddle-shaped accessory piece, about 0·09 mm. long.

The posterior end of the female is bluntly conical, and the anus is subterminal. The vulva, which is not prominent, is situated at a distance of about 0·1 mm. from the anus. A prepuce-like fold of cuticle frequently covers both vulva and anus, and may completely cover the tail. The vagina runs forward for a distance of about 1 mm. from the vulva, and opens into a pair of directly opposed ovejectors, the combined length of which is about 1·1 mm.

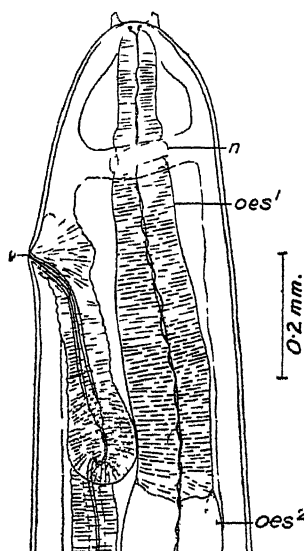
The posterior branch of the uterus turns forward immediately to run parallel to the anterior branch. The eggs are somewhat smaller than those of *T. brachylaima*, measuring 0.11–0.13 mm. $\times$ 0.06–0.07 mm.

Family **Diaphanocephalidæ**.

Kalicephalus ? *obliquus* (Daubney, 1923).

A pair of specimens, in poor condition, from *Bitis nasicornis* at Mamfe, Cameroons, are somewhat doubtfully referred to this species.

Fig. 8.



Setaria sandersoni, sp. n. Anterior end of female; lateral view.

n., nerve-ring; oes.¹, oes.², anterior and posterior portions of œsophagus; v., vulva.

Family **Filariidæ**.

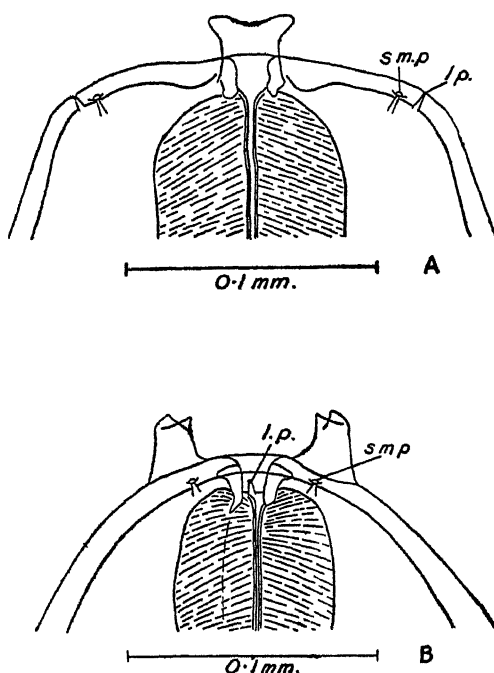
Setaria sandersoni, sp. n.

(Figs. 8–11.)

Of this species one male and seven females were obtained from the peritoneal cavity of a duiker (*Philantomba melanorhea*) at Bashauo, Mamfe Division, Cameroons. It closely resembles *S. southwelli* Thwaite, 1927, from

Cephalophus sp. in Sierra Leone. Through the kindness of Dr. T. Southwell, the writer has been able to examine the type-specimens of *S. southwelli*, which are in the collection of the Liverpool School of Tropical Medicine. The material from the Cameroons, though differing from *S. southwelli* only in very small characters, appears to represent a distinct species.

Fig. 9.



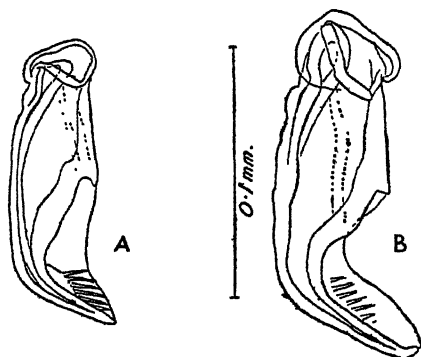
Setaria sandersoni, sp. n. Anterior end of female.
A, dorsal view; B., lateral view.

l.p., lateral papilla; *s.m.p.*, submedian papilla.

The male measures about 60 mm. in length and 0.33 mm. in maximum thickness, the females about 90–135 mm. and 0.5–0.7 mm. respectively. The “peribuccal ring” is represented by dorsal and ventral projections (figs. 8, 9) which are not simple and conical, as in *S. southwelli*, but somewhat expanded and bifid at their free ends, having a shape very similar to that of some specimens

of *S. hornbyi* Boulenger, as figured by Thwaite (1927, especially fig. 8 A & B). The cuticular walls of the mouth-cavity are considerably thickened, forming a small "buccal capsule." The total length of the oesophagus is about 9.7 mm. in the male and 9.5–12 mm. in the female. Its anterior, muscular portion measures 0.65–0.9 mm. The nerve-ring is situated at about 0.2–0.25 mm., and the cervical papillæ at about 0.4–0.46 mm. from the anterior extremity.

Fig. 10.



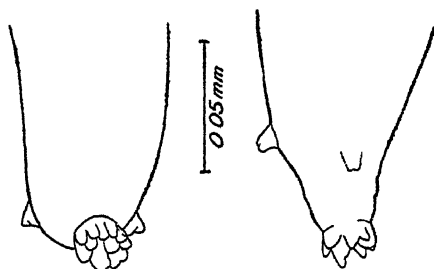
Right spicule, viewed from right side,
A, of *Setaria sandersoni*, sp. n.; B, of *S. southwelli* Thwaite.

The tail of the male is relatively short (0.09 mm.) and bluntly conical, as in *S. southwelli*. Eight papillæ were made out on each side, but on the left (in the single male available) three of these were preanal and five postanal, while on the right four were preanal and four postanal. The most posterior pair of papillæ are extremely small. The spicules are of very similar form to those of *S. southwelli*, but slightly smaller. The longer (left) spicule measures 0.32 mm. in total length, and its tubular proximal portion measures 0.17 mm. The right spicule (fig. 10 A) measures 0.115 mm. in length in a straight line from root to tip. There is a very conspicuous hook-like projection at about the middle of its ventral surface, and at its distal end it bears on the left side a membranous expansion which has a ribbed or fluted appearance. These features are also present in the right spicule of *S. south-*

welli, a figure of which, drawn to the same scale, is given for comparison (fig. 10 B).

The tail of the female measures 0.31–0.42 mm. in length. Its extremity (fig. 11) is somewhat variable in shape, being more bluntly rounded in some specimens than in others. It bears a terminal rosette of relatively large tubercles. These are variable in number and size, and also in shape, being sometimes bluntly rounded, sometimes more conical. Occasionally some of the larger tubercles appear bifid. The paired lateral appendages, which are situated near the extremity, are relatively small and more or less conical. The vulva is situated at 0.3–0.45 mm. from the anterior end, and is rather prominent. It leads into a muscular vagina whose distal portion, or ovejector,

Fig. 11.



Setana sandersoni, sp. n. Extremities of the tails of two females.

ending posteriorly in a rounded bulb, is 0.35–0.45 mm. long.

The possibility has been considered that this species might be identical with *S. cornuta* (v. Linstow, 1899), from an unnamed antelope in the Cameroons. Unfortunately the original description of this species is very inadequate, but the lengths of the spicules are given as 0.104 mm. and 0.078 mm. respectively, while the oesophagus appears to be not more than half as long as in the present form. Boulenger (1928) has given a description of specimens from *Cephalophus monticola* from West Africa, which he identifies with *S. cornuta*. The writer has re-examined some of Boulenger's material, and is

inclined to refer it to *S. southwelli* Thwaite, the description of which was not available to Boulenger at the time of writing his paper. The lengths of the spicules are given by Boulenger as 0.32 mm. and 0.18 mm. respectively. In the male examined by the writer they were found to be 0.33 and 0.14 mm., thus agreeing closely with *S. southwelli*. The length of the œsophagus in a female is 17 mm., whereas in *S. cornuta*, according to v. Linstow, the œsophagus of the female is $\frac{1}{22.5}$ of the total length, which is about 4.3 mm. for a specimen 97 mm. long.

It may be mentioned here that in some of the male specimens of *S. southwelli* a small and inconspicuous fourth pair of postanal papillæ was observed, in addition to the three pairs seen by Thwaite. As regards the caudal papillæ, therefore, there seems to be no difference between *S. southwelli*, *S. sandersoni*, and *S. cornuta*.

Family Spiruridæ.

Protospirura muricola Geddoelst, 1916.

This species, which is very common in African Muridæ, occurred in the stomach and duodenum of *Lemniscomys pulcher* at Eshobi, and on two occasions at Mamfe in an undetermined species of rat. In one of these cases it was found in the intestine; in the other Mr. Sanderson, on opening the brain-case of the rat, found a single female specimen lying between the skull and the brain. A single female was also found (probably as a pseudoparasite) in *Genetta tigrina fieldiana* at Mamfe.

Habronema hamospiculatum (Neveu-Lemaire, 1927).

Examples of this species, which was the subject of a previous note by the writer (1931), were obtained from the intestine of a pangolin (*Manis tricuspis*) at Bashauo, Mamfe Division, Cameroons.

Streptopharagus ? *pigmentatus* (v. Linst., 1897).

Two female specimens, probably belonging to this species, were obtained from different monkeys—one from *Cercopithecus mona* at Mamfe and one from *C. nictitans* at Eshobi. In the latter case the worm was found by Mr. Sanderson in the left lung.

Physaloptera ? paradoxa v. Linst., 1908.

Several specimens (including only one male) of a form very closely related to, if not identical with, this species were obtained from the mouth and throat of *Agama agama* at Ikom, Southern Nigeria.

REFERENCES.

- BAYLIS, H. A. 1931. "On a Nematode Parasite of Pangolins." *Ann. & Mag. Nat. Hist.* (10) viii. pp. 191-194.
- BOULENGER, C. L. 1928. "Report on a Collection of Parasitic Nematodes, mainly from Egypt.—Part V. Filarioidea." *'Parasitology,'* xx. pp. 32-55.
- LINSTOW, O. VON. 1899. "Nematoden aus der Berliner Zoologischen Sammlung." *Mitt. Zool. Mus. Berlin*, i. pp. 3-28, pls. i.-vi.
- . 1901. "Helminthen von den Ufern des Nyassa-Sees, &c." *Jena. Zeitschr. f. Naturwiss.* xxxv. pp. 409-428, pls. xiii., xiv.
- MÖNNIG, H. O. 1924. "South African Parasitic Nematodes." *Union of S. Africa, Dept. of Agric., 9th and 10th Rep. Dir. Vet. Educ. & Res., Pretoria*, pp. 435-478.
- . 1931. "A Second Species of the Nematode Genus *Acanthoxyurus*." *Union of S. Africa, 17th Rep. Dir. Vet. Serv. & Anim. Indust.* pp. 269-272.
- PRICE, E. W. 1932. "The Trematode Parasites of Marine Mammals." *Proc. U.S. Nat. Mus.* lxxxi. Art. 13, pp. 1-68, pls. i.-xii.
- SANDGROUND, J. H. 1928. "Some new Cestode and Nematode Parasites from Tanganyika Territory." *Proc. Boston Soc. Nat. Hist.* xxxix. pp. 131-150, pls. xvi.-xxi.
- STUNKARD, H. W. 1929. "The Parasitic Worms collected by the American Museum of Natural History Expedition to the Belgian Congo, 1909-1914.—Part I. Trematoda." *Bull. Amer. Mus. Nat. Hist.* lviii. Art vi. pp. 233-289.
- THWAITE, J. W. 1927. "The Genus *Setaria*." *Ann. Trop. Med. & Parasitol.* xxi. pp. 427-466.
- TURNER, M. 1921. "On some Helminth Parasites of an East African Rock Rabbit (*Procapra* sp.)." *Trans. Roy. Soc. Trop. Med. & Hyg.* xv. pp. 182-189.

XXIII.—*Notes on Cecidomyidæ.*—II. By H. F. BARNES, M.A., Ph.D. (Entomology Department, Rothamsted Experimental Station).

THIS paper contains descriptions and notes on various Cecidomyidæ of potential or actual importance. They have been received for identification in recent years from abroad. The midges are dealt with in alphabetical order of the country of origin for simplicity. Descriptions of four new species are included. The first paper in this series was published in this periodical in 1932 (ser. 10, vol. ix. pp. 475-84).

The following is a list of the species noted, together with their country of origin :—

Species.	Country.
<i>Lestremia ugandæ</i> , sp. n.	Uganda.
<i>Johnsonomyia</i> sp.	Sierra Leone.
<i>Dasyneura lini</i> , sp. n.	India.
<i>Stephodiplosis nothofagi</i> , sp. n.	New Zealand.
<i>Hyperdiplosis triticea</i> , sp. n.	Kenya Colony and Egypt.
Mite-eating Gall Midge	New Zealand.

INDIA.

Some alcohol material of a midge reared in March 1933 from orange larvæ feeding on pollen of the flowers of linseed, collected by Bhatia at Pusa, India, were received in March 1934 from the Imperial Entomologist through the Imperial Institute of Entomology. At the same time three dry specimens, labelled "H. N. Batra, on linseed, cage no. 36, Pusa, March 1933," were received. These specimens, which are in very poor condition, are presumably examples of the same rearing.

This species runs down in Felt's key (1925) and Kieffer's key (1913) to the genus *Dasyneura* Rond., but among other characters the genitalia are not quite typical of this genus. Nevertheless, it is proposed to refer it tentatively to this genus and describe it as *D. lini*, sp. n.

Dasyneura lini, sp. n.

Male.—Length slightly over 1 mm. Antennæ : 2+13 ; 1st and 2nd flagellar segments fused ; neck of 1st flagellar segment distinctly short, only slightly longer than broad, not half as long as basal portion of segment ; neck of 2nd flagellar segment nearly three times as long as broad and nearly as long as basal portion of segment ; neck of 3rd flagellar segment about three times as long as broad and as long as basal portion ; succeeding flagellar segments the same proportions, but gradually diminishing in size. Palpi : four segments, proportions indistinct, but distal segment distinctly longer than 3rd. Thorax dark dorsally, rest of thorax and abdomen fuscous. Wings : 3rd vein reaching costa well before apex of wing ; 5th vein forked. Legs : claws all toothed, empodium nearly as long as claws. Genitalia : basal clasp segment about one and a half times as long as broad, with a few

long setæ on inner surface, unusually broad ; distal clasp segment long, narrow, just over seven times as long as broad ; dorsal lamella with deep V-shaped emargination, each lobe rounded ; ventral lamella nearly as long as dorsal lamella, with shallow U-shaped emargination, each lobe narrow and rounded ; harpes long ; style reaching just beyond harpes. Genitalia of Cecid. 2227 has an abnormal lamella with a long prolongation, otherwise normal.

Cotypes, Cecid. 2225–7 inclusive.

Female.—Length about 1.5 mm. Antennæ : scape and pedicel yellow, flagellar segments dark, 2+12, flagellar segments bead-like, progressively smaller. Palpi : four segments, proximal segment quadrate ; 2nd about twice as long as 1st and slightly longer than broad ; 3rd about three times as long as broad and nearly twice as long as 2nd ; distal segment half again as long as 3rd and about six times as long as broad. Head of one midge on Cecid. 2230 completely malformed. Ovipositor pocket-shaped, largely protusible. Otherwise about as in male.

Cotypes, Cecid. 2228–31 inclusive.

Habitat. Orange larvæ on pollen of linseed flowers (*Linum usitatissimum*), Pusa, India.

Recently (April 1935) further specimens of *Dasyneura lini* (males, Cecid. 2493–4 : females, Cecid. 2495–6) have been received from Dr. Hem Singh Pruthi, who writes saying that a note on the life-history of this midge is under preparation.

The only other gall midge hitherto described from *Linum* is *D. sampaina* Tav. (1902), whose larvæ produce oval terminal leaf-bud galls on *L. usitatissimum* and other species of *Linum* in Europe. But Bequaert recorded in 1914 a globular flower gall, each containing an orange-red larva on *L. strictum* in Algeria.

KENYA COLONY.

In January 1934 a set of pinned gall midges, reared by R. H. Le Pelley in 1932 from larvæ feeding on *Puccinia triticina* at Kiambu, Kenya Colony, were received from the Imperial Institute of Entomology. They are provisionally referred to the genus *Hyperdiplosis* Felt (1908). It is proposed to describe the species as *H. triticina*, sp. n.

Hyperdiplosis triticina, sp. n.

Male.—Length slightly over 1 mm. Antennæ: more than one-half again as long as body, 2+13; scape and pedicel yellow, flagellar segments pale brown, the three rings of circumfila regular with moderately long loops; 3rd flagellar segment with stem three times as long as broad, neck slightly more than three times as long as broad and the same width as stem, distal enlargement about twice as long as basal enlargement and slightly constricted at the basal half; stem and neck of 10th flagellar segment about the same length as those of 3rd segment but three-quarters the widths, stem of 10th about four times as long as broad, neck about five times as long as broad; 12th flagellar segment with normal stem and short neck surmounted by small enlargement, about half the size of basal enlargement of 12th flagellar segment, with setose prolongation, this enlargement and prolongation forms the 13th flagellar segment and is not fused to 12th. Palpi: four segments, proportions indistinct; proximal segment small, quadrate; 2nd slightly longer; 3rd longer than 2nd and broader; distal segment largest. General body-colour yellowish orange. Wings: 3rd vein interrupting costa beyond tip of wing; 5th vein forked. Claws bent almost at right angles, all simple, empodium minute. Genitalia: basal clasp segment about twice as long as broad, without conspicuous basal lobe; distal clasp segment long, moderately stout; dorsal lamella bilobed, each lobe broadly rounded; ventral lamella deeply incised, each lobe long and very narrow; style moderately stout, slightly longer than lobes of ventral lamella.

Cotypes, Cecid. 2416–21, 2441 and 2465.

Female.—Length about 1.25 mm. Antennæ: 2+13, flagellar segments cylindrical with moderate-lengthed necks; 12th flagellar segment with neck surmounted by a drop-shaped structure, scarcely fused with it. Palpi: of indistinct proportions, apparently about as in male. Claws simple, though a claw on a fore-leg on two slides (Cecid. 2442 and 2425) apparently has a minute basal tooth. Ovipositor lamelliform, each lateral lobe broad and round, basal lobe very small. Otherwise about as in male.

Cotypes, Cecid. 2422–7 and 2442.

Habitat. Larvæ feed on *Puccinia triticina*, Kiambu, Kenya Colony.

Just recently (June 1935) further specimens (females, Cecid. 2547-9) of *Hyperdiplosis triticina* have been received from the Imperial Institute of Entomology. They were sent for identification by Dr. H. Priesner, Egypt, and were labelled "Cairo, *Puccinia* on wheat, May 1935." Therefore this species is now known to occur in Kenya Colony and Egypt.

This species is obviously closely related to *Mycodiplosis* Rübs. (1895), but can be separated on account of the simple claws, which are bent nearly at right angles, and the minute empodium.

NEW ZEALAND.

The following species was received in June 1934 from the Imperial Institute of Entomology. It runs down in Felt's key (1925) to *Stephodiplosis* Tav. (1908), and without much doubt it is closely allied to this genus, which was created for a single species found in Mozambique, Africa, and reared from galls on *Lannea fulva* Engl. (Anacardinaceæ). The specimens under consideration were reared from bud-galls on *Nothofagus cliffortioides* at Cass, New Zealand, by L. Morrison in August 1933. They are described below as a new species and tentatively placed in the genus *Stephodiplosis*.

Stephodiplosis nothofagi, sp. n.

Male.—Length about 2.5 mm. Antennæ: 2+12, each flagellar segment binodose; 1st and 2nd flagellar segments partially fused; each node with one ring of circumfila with long loops, twelve loops on the basal node of the 3rd flagellar segment, nine on the distal node of the same segment, each loop about twice as long as the basal node; length of basal node, stem, distal node, and neck of 3rd flagellar segment as 20 : 15 : 25 : 20, stem just under one and a half times as long as broad, neck about twice as long as broad; stem of 10th flagellar segment nearly twice as long as broad, neck about three and a half times as long as broad; 12th and distal segment with stem gradually blending into distal node giving the appearance of club-like appendage to basal node. Palpi: long, four segments, pubescent with a few setæ, dark; proximal segment elongate quadrate; 2nd slightly

longer, cylindrical; 3rd considerably longer and more slender; distal segment slightly longer than 3rd, but about the same width. Thorax dark brown, more pale laterally. Wings: 3rd vein reaching costa just beyond apex of wing, not interrupting the margin, slightly curved distally; 5th vein forked, upper branch continuing direction of the stem. Claws all simple, empodium about the same length or slightly longer than the claws. Genitalia: basal clasp segment stout, about twice as long as broad, pubescent with a few long setæ; distal clasp segment broad until just before extremity, when it narrows considerably, pubescent; dorsal lamella, short, broad, widely emarginate, emargination equal in size to either lobe, each lobe rounded, with short setæ distally; ventral lamella longer than dorsal, deep U-shaped emargination, lobes rounded, a few short setæ distally; style stout, long.

Cotypes, Cecid. 2408-9 and 2412-13.

Female.—Length about 3 mm. Antennæ: 2+12; 1st and 2nd flagellar segments fused and elongated, constricted, with definite waists, succeeding segments gradually decreasing in size, all flagellar segments with two rings, proximal and distal, of long stout setæ, circumfila almost applied; 3rd flagellar segment much shorter than 2nd, but with waist, basal portion about twice as long as broad, neck nearly twice as long as broad; 10th flagellar segment without waist, basal portion about twice as long as broad, neck about twice as long as broad. Palpi: about as in male. Ovipositor, dark, blunt, apparently with two medium-sized rounded lobes and small basal lobe, extensile. Otherwise about as in male.

Cotypes, Cecid. 2410 and 2411.

Habitat. Bud-gall on *Nothofagus cliffortioides*, Cass, New Zealand.

Midge whose Larvæ feed on Mites.

In April 1933 two specimens of a midge whose larvæ are predacious on *Paratetranychus pilosus* in New Zealand were sent by W. Cottier of the Plant Research Station, Palmerston North, through A. L. Tonnoir.

Unfortunately, both specimens (Cecid. 2317 and 2318) are females, and it is impossible to place them generically with any certainty. However, they belong to the Triflora group of the Cecidomyinæ and are presumably close

to *Feltiella* Rübs. (1911) and *Acaroletes* Kieff. (1912). But the claws are not sufficiently clear to say whether they are all simple, which appears to be the case, or whether the anterior ones are toothed. Other characters exhibited by the midges in question are:—Palps with four segments, 3rd vein interrupting costa at apex of wing which is hyaline, 5th vein forked, empodium shorter than the claws, ovipositor with two lobes and general size about 1 mm.

This midge is mentioned as *Arthrocnodax* sp. by Cottier (N.Z. J. Sci. & Tech. xvi. 1934, pp. 68–80) in an article on the natural enemies of *Paratetranychus pilosus* Can. & Fanz. The writer states that as a check on the red mite this species of midge is unimportant. He also figures the male genitalia, male antenna, and a four-segmented palp, as well as an adult female and a larva.

The main interest of this record, however, is the fact that it is the first time a mite-eating Cecidomyid has been reported from New Zealand. Other records of gall midges as enemies of mites show that the distribution of such forms extends over Europe, U.S.A., the West Indies, S. Russia, Ceylon, and Java (for further information see Bull. Ent. Res. xxiv. 1933, pp. 215–228).

SIERRA LEONE.

Johnsonomyia sp.

In March 1933 a single pinned specimen was received through the Imperial Institute of Entomology from E. Hargreaves. It was labelled "Njala, Sierra Leone, 21. x. 32." Unfortunately, the genitalia were missing. However, it (Cecid. 2428) is apparently a species of the genus *Johnsonomyia* Felt (1908).

So far six species have been assigned to this genus:—*J. rubra* Felt (1908), *J. fusca* Felt (1908), and *J. humilis* Felt (1908) from the United States of America; *J. cincta* Felt (1912) from Guatemala; *J. braziliensis* Felt (1915) from Brazil; and *J. alexanderi* Felt (1921) from the Cameroons. All have been caught, and nothing is known about their life-histories. They are large-sized midges varying from 4 to 8 mm. in length.

UGANDA.

A tube of midges caught on coffee in September 1933 by H. Hargreaves (0477) at Bukumbi, Uganda, was

received for identification from the Imperial Institute of Entomology in March 1934. There were five males of the same species in the tube, and they belong to the genus *Lestremia* Macq. (1826). The larvæ of species of this genus usually feed on decaying wood, etc. It is proposed to describe the species caught on coffee as *L. ugandæ*, sp. n.

Lestremia ugandæ, sp. n.

Male.—Length about 2 mm. Antennæ: scape yellowish, pedicel and flagellar segments brownish, 2+14; 3rd flagellar segment with neck about four-fifths the length of basal portion and nearly four times as long as broad; neck of 10th flagellar segment about two-thirds the length of basal portion and about four times as long as broad; 14th flagellar segment between two and three times as long as broad, slightly constricted distally; sensory appendages on basal flagellar segments simple. Palpi: long, bristly, four segments; proximal segment about twice as long as broad; 2nd three to four times as long as broad; 3rd seven to nine times as long as broad; distal segment ten to twelve times as long as broad and a fifth as long again as 3rd; 3rd and 4th segments narrower than 1st and 2nd. Thorax dark brown dorsally, yellowish on sides. Wings: subcosta joining costa at basal third; 3rd vein joining and interrupting costa just beyond basal two-thirds, very close to subcosta, basally appearing to be continuation of subcosta; stem of 4th vein slightly curved, nearly half as long as the branches of its fork; 5th vein obsolete proximally; 6th vein complete. Legs thickly clothed with hairs, ratio of tarsal segments on fore-legs about as $5:2\frac{1}{2}:2:1\frac{1}{2}:1$; on mid-legs about as $6\frac{1}{2}:2\frac{1}{2}:2:1\frac{1}{2}:1$; on hind legs about as $9\frac{1}{2}:4:3:2:1$; claws strongly curved, minute pectination, empodium well developed, nearly as long as claws. Abdomen fuscous-brown. Genitalia: basal clasp segment long, narrow, slightly more than three times as long as broad; distal clasp segment tapering to a sharp point: rest of genitalia not distinguishable into component parts in the preparations, except for two long hooked processes and two lateral valves visible in Cecid. 2326.

Cotypes, Cecid. 2325–9 inclusive.

Habitat. Caught on coffee, Bukumbi, Uganda.

XXIV.—*A Mechanical Investigation into the Effectual Action of the Caudal Fin of some Aquatic Chordates.*

By A. J. GROVE, M.A., D.Sc., and GORDON E. NEWELL, B.Sc., Department of Zoology, Queen Mary College, University of London.

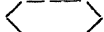
IN the literature dealing with the morphology and functions of the caudal fin of Fishes, divergent views are expressed with respect to their effectual action. This is perhaps particularly so in connection with the effect of the heterocercal condition. Ryder (1886) suggests that the existence of a larger lower lobe causes an upward drive, and therefore the axis has turned upwards in response to the mechanical stimulus. Ahlborn (1896), discussing the significance of heterocercy, states that, owing to the reaction of the water on the more flexible distal portion of the lobes, the effect is to raise the tail. The resulting depression of the head is counter-balanced by the elevating effect of the pectoral fins. Schmalhausen's (1912) views are that the action of the upper lobe drives the tail downwards, but this is counteracted by the opposing action of the lower lobe, this action being developed in correlation with the heaviness of the head. It is to be inferred, though he does not appear to say so definitely, that the effect of heterocercy is to raise the tail. Whitehouse (1918), in his interesting speculations on the evolution of the caudal fin, suggests that the effect of heterocercy is to continue the upward progression of the fish after the rearing upward of the head region. Graham Kerr (1919) explains the action of the heterocercal tail as associated with the rotation of the body about its long axis. Breder (1926) states definitely that the heterocercal tail drives the tail region upwards and the head region downwards, the downward drive of the head being offset by the inclination of the pectoral fins. Goodrich's (1931) view is that heterocercy is useful to counteract the heaviness of the head. Watson (1935) describes the effect of heterocercy as causing the tail region to rise, thus enabling a fish heavier than water, with the combined action of the pectoral fins, to rise from the bottom.

Although there are points of contact between some of these views, there are also divergences, and it seemed to

us that the problem of the effectual action of the heterocercal tail was susceptible of solution experimentally by means of models.

A model of a typical heterocercal tail was therefore made from flexible celluloid and paper doped with celluloid dissolved in acetone. The celluloid was shaped to represent the "body" of the fish (*i. e.*, skeleton and muscle) in the tail region, whilst the paper was cut to represent the caudal fin, treated with the celluloid solution, and while still wet, stuck in position on the "body." Paper treated in this way was found to have much the same order of flexibility as that of the fin of such a fish as a dogfish.

[As the result of experience, it was found that it is essential that the degree of taper in the celluloid "body" should be similar to that represented in fig. 2. If the celluloid is too narrow at the truncated end, the sinuous movements are not adequately communicated to the fin. Also the model should only be used in water once. After being wet and subsequently allowed to dry, the doped paper has a tendency to buckle and lose its flexibility.]

The model was pivoted through a hole at the truncated end to the spindle of the piece of apparatus represented in fig. 1 A & B (p. 283). This consisted of a stout piece of flat brass, to the centre of which two upright pieces of similar brass shaped thus  in section were fastened. Near the free ends of the uprights, a spindle was arranged on which were two collars (see fig. 1 B), between which the model could move in a vertical direction. The whole apparatus was then lowered into a glass tank of water so that the cross-piece rested on the top of the tank, whilst the model lay with its "anterior" end just above the bottom, the "posterior" extremity resting on the bottom since the model was heavier than water. The cross-piece was then pushed to and fro in the direction of its length across the top of the tank in such a way as to impart to the celluloid, sinuous movements simulating those of the body of a fish when swimming.

At first, the hypochordal lobe merely scraped along the bottom of the tank, but soon the whole model began to rise from the bottom and, pivoting around the spindle, rotated through nearly 90 degrees—that is, until it stood nearly upright in the water. As soon as the to-and-fro

movement of the cross-piece was arrested, the model reverted to its original position. While this experiment appears to show conclusively that the effect of a heterocercal tail is to raise the tail region from the bottom, a possible criticism is that the effect may have been produced by eddies created by the oscillation of the suspending pieces of the apparatus. To test this, the model was reversed so as to form the reversed heterocercal type of tail—that is to say, the upper lobe was now larger than the lower, and the axis bent downwards. The experiment was then repeated, and in this instance no amount of movement of the cross-piece would cause the model to rise. A further and rather striking check was made with the model still in the reversed position, but made lighter than water by strips of cork fastened on both sides of the celluloid so that it floated quite vertically in the water. With the commencement of the to-and-fro motion of the cross-piece, the model immediately began to move downwards and soon it rested on the bottom, the inverted “raising” effect having been effective even against the buoyancy of the corks.

These simple experiments seem to establish without doubt that the mode of functioning of the heterocercal tail is concerned with *raising the tail region* of the animal from the bottom.

That the tail is responsible for the forward propulsion of the animal is generally accepted and has been examined in detail by Breder (1926) and Gray (1933). In order to demonstrate both the propulsive and raising action, the apparatus was modified in the following manner. Each of the supporting uprights was hinged at a point six inches from the spindle, so as to permit the forward movement of the model. The hinged portion was made of aluminium, so as to be as light as possible and not offer too much resistance to the action of the model.

The experiment was then repeated with the model in the normal heterocercal position. As soon as the sinuous movements had become established in the celluloid, the model moved from the bottom and the spindle was propelled forward until the lower hinged portion of the uprights was nearly at right angles with the upper portion. When the lower portion had reached a certain angle with regard to the upper part (represented by the equali-

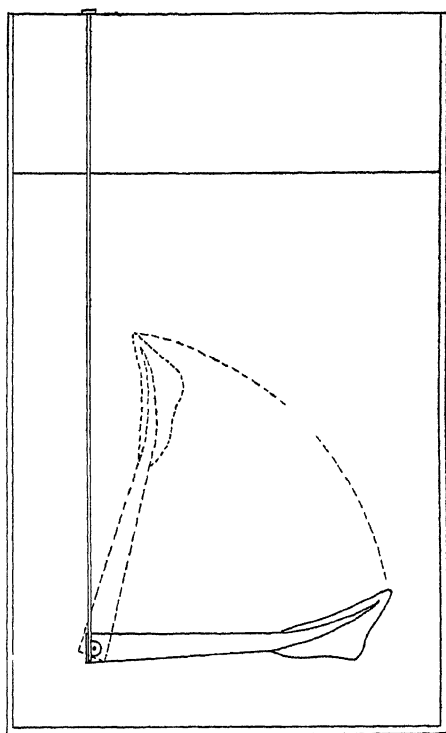
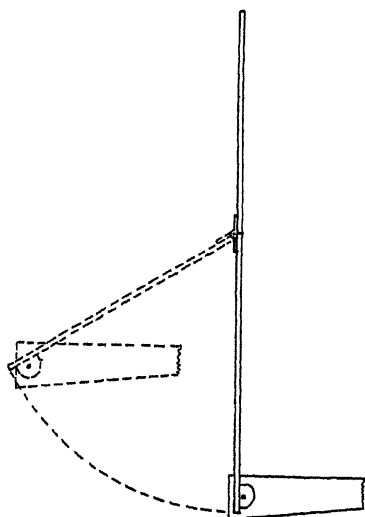
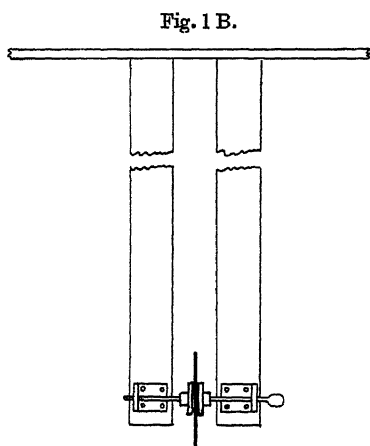


Fig. 1 C.



sation of the propulsive force with the "weight" of the hinged portion) the model—which up to this time had remained practically horizontal with the "caudal fin" free from the bottom—commenced to rise still further as in the initial experiment.

In the actual experiment, the forward movement became apparent before the raising action was marked. But this, of course, was merely an idiosyncrasy of the particular piece of apparatus used, for if the relative weight of the movable part of the apparatus had been greater, it is possible that the raising movement of the model would take place before sufficient propulsive force had been developed to overcome the "weight" of the movable part. This was tested by adding lead weights to the hinged portion, and although the experiment must obviously be sheerly empirical, it is theoretically possible to so adjust the variables—*i. e.*, the "weight" of the hinged portion of the apparatus and the size of the fin portion of the model—until the forward propulsion and raising movement would take place simultaneously.

In this way, then, it was possible to demonstrate that the movements of the heterocercal tail during the swimming of a fish, in addition to propelling the animal forwards, raise the tail region from the bottom. As a final test, an experiment was made with an actual tail taken from a fresh dogfish. This was pierced at the cut end to allow the spindle to pass through and tested in the same way as the model. Precisely the same raising and propulsive movements were observed, though the size of the specimen caused some difficulties in manipulation of the apparatus.

The successful results obtained from these experiments suggested a further series on similar lines with other types of caudal fin. An examination of the figures, in various publications, of the caudal fins of Cephalochordata, Cyclostomata, Elasmobranchii, and Teleostomi reveals a multitude of types each with its own peculiar characteristics. When these are analysed, however, they may all be said to be referable to one or other of the following types:—

Type 1 (fig. 2 A, p. 286).—In which the axis of the caudal skeleton is turned upwards and the epichordal lobe is smaller than the hypochordal lobe. [The typical heterocercal tail of some fossil Cyclostomata, Elasmobranchii, and most "Ganoids."]

- Type 2 (fig. 2 B).—In which the caudal axis is bent upwards and the epichordal and hypochordal lobes are equal in size. [The type of tail * found in the living Cyclostome *Petromyzon fluviatilis*.]
- Type 3 (fig. 2 C).—In which the caudal axis is bent downwards and the epichordal and hypochordal lobes are equal in size. [The type of tail † found in the living Cyclostome *P. marinus*.]
- Type 4 (fig. 2 D).—In which the caudal axis is bent downwards but the epichordal lobe is smaller than the hypochordal lobe. [The type of tail ‡ in the early pelagic larva of *Amphioxus*.]
- Type 5 (fig. 2 E).—In which the caudal axis is straight and the epichordal and hypochordal lobes are equal in size. [The type of tail found in the adult *Amphioxus* and the diphyrcercal and gephyrocercal tails of Teleostei and some extinct Ostracodermata.]
- Type 6 (fig. 2 F).—In which the caudal fin is externally symmetrical and the lobes of the fin are equal in size, but project backwards beyond the axis. [The homocercal tail of Teleostei.]

Models were therefore made embodying these characteristics and tested on both pieces of apparatus with the following results:—

Type 1.—Axis bent upwards; hypochordal lobe larger.

(a) On fixed uprights.

The model rose from the bottom.

(b) On hinged uprights.

The movable portion of the apparatus was propelled forwards and the model rose from the bottom until an optimum position was reached, when the model continued to rise.

Type 2.—Axis bent upwards; lobes equal.

(a) On fixed uprights.

The model remained at the bottom and showed no inclination to rise. When made lighter than water by the attachment of corks the model moved downwards, exactly as in the case of the reversed heterocercal model.

(b) On hinged uprights.

The model propelled the movable portion forwards, but continued to tend downwards.

Type 3.—Axis bent downwards; lobes equal.

(a) On fixed uprights.

The model rose from the bottom in precisely the same way as the heterocercal model.

(b) On hinged uprights.

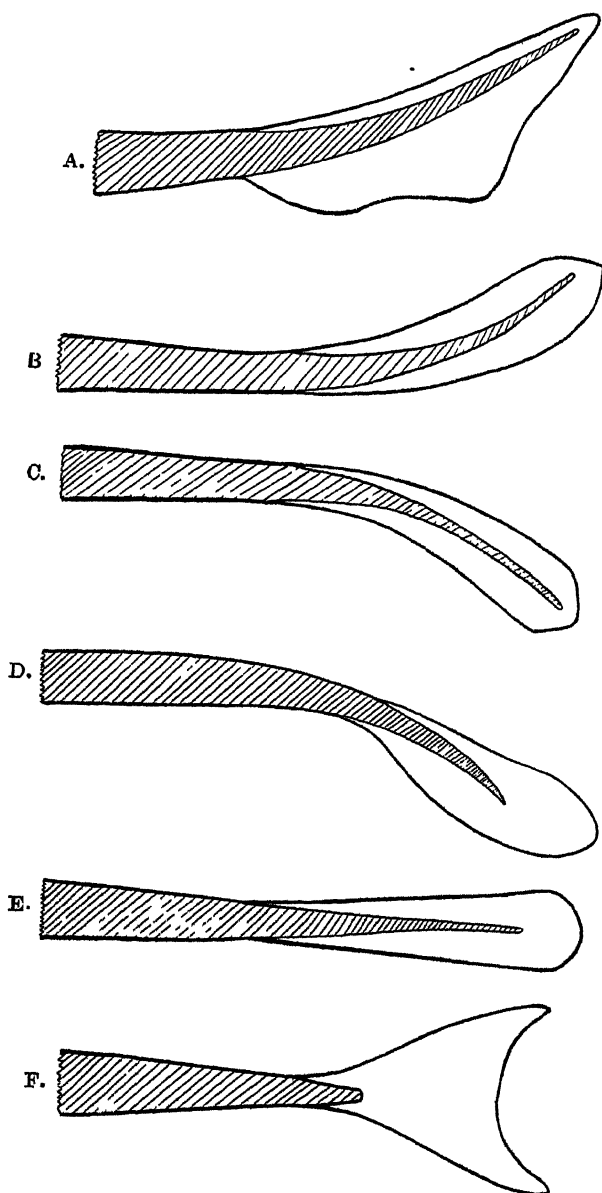
The movable portion was propelled forwards and the model rose from the bottom as in the case of the heterocercal model.

* This statement is based upon observations of the tail of living specimens.

† This statement is based upon observations on preserved and museum specimens, and, although enquiries have been made for confirmation from living specimens, this has not yet been obtained.

‡ This statement is based upon the figures of Hatschek, Willey, and Conklin, but has not been confirmed from actual observation as the material has been hitherto unobtainable.

Fig. 2.



Diagrams of the model tails used in the experiment.

Type 4.—Axis bent downwards; hypochordal lobe larger than epichordal.

(a) On fixed uprights.

The model behaved in the same way as Types 1 and 3.

(b) On hinged uprights.

The model behaved in the same way as Types 1 and 3.

Type 5.—Axis straight; lobes equal.

(a) On fixed uprights.

The model merely scraped along the bottom and no raising effect was noticeable.

(b) On hinged uprights.

The only effectual motion was a forward propulsion of the movable portion of the apparatus. Such upward and downward movement as was noticed was merely incidental to the mode of testing and was "aimless."

Type 6.—Fin symmetrical; lobes equal, but extending beyond the axis.

(a) On fixed uprights.

The model behaved in the same way as Type 5.

(b) On hinged uprights.

The movable portion of the apparatus was driven forwards powerfully, and no upward or downward movements were noticeable.

An examination of the results of these experiments shows that, whatever may be the morphological constitution of the caudal fin, its effectual action, in addition to the forward propulsion of the body of the animal, falls into one of three categories :—

1. To raise the tail region from the bottom.
2. To prevent the tail region from rising.
3. To neither raise nor depress the tail region.

It follows, then, that however accurately the terms heterocercal, homocercal, diphyrcercal, and gephyrocercal may describe the morphology of the caudal fin of any particular fish, it does not necessarily follow that the term also implies a particular effectual action. This was demonstrated by making a model the shape of a heterocercal tail, but with a perfectly straight axis (fig. 3, p. 288). Its performance on the apparatus was precisely the same as that of the normal heterocercal model. The only conclusion that can be drawn, therefore, is that the explanation of the effectual action of the caudal fin lies in the consideration of the relative sizes of the epichordal and hypochordal lobes, and, consequently, what may appear to be morphologically a diphyrcercal tail may, by modification of the inclination of its axis, be converted into an effectual heterocercal tail or one in which the action of

that type is reversed. Also, that the action of a diphyrcercal or gephyrocercal tail in which the axis remains straight is the same as that of a homocercal tail.

Fig 3

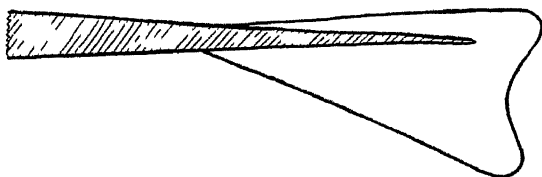


Diagram of a tail with a straight axis and the hypochordal lobe larger than the epichordal lobe

MECHANICAL EXPLANATION.

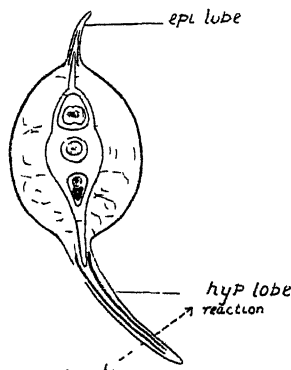
There appears to be a simple mechanical explanation of the three types of effectual action enumerated above. Considering the case of heterocercy, when the caudal fin is moved to and fro as the result of the sinuous lateral movements of the body, the peripheral portion of the fin will be flexed by the resistance of the water, so that at the end of the stroke the position of the fin as seen in transverse section will be roughly that represented in fig. 4. In a resolution of the forces acting on both lobes, there will be a vertical component; but, since the lower lobe is larger than the upper, the magnitude of its vertical component will be greater than that of the upper, and, since they are opposed to one another, the resultant will cause the tail region to rise. Similarly, in a tail with a straight axis and both lobes equal in size, the vertical components will be equal and opposite, and will consequently neutralise one another, so that the tail will neither be raised nor depressed; the other components will merely augment the forward propulsion of the body. If, however, the caudal axis is bent downwards, then, so far as the main longitudinal axis of the body is concerned, most of the fin lies below it, and consequently the action is that of the heterocercal condition. The case where the axis is bent upwards and the lobes equal in size is explicable on the same lines.

The importance of some exact knowledge of the effectual action of the caudal fin lies not only in the correlation

of the form with the function of the fin and its bearing on the habits of the animal, but also as providing new insight into the possible evolutionary sequence of the various types. It is obviously outside the province of this paper to enter that discussion, but this will be attempted by one of us (G. E. N.) in a separate publication.

Our attention has been drawn to the tail of the *Ichthyosauria*. In this group of reptiles, as in the fishes, the chief propulsive organ was the tail, but in this case the vertebral column was bent downwards and passed into the smaller lower lobe of the fin. During the evolution of the group there was a progressive enlargement of the

Fig. 4.



Diagrammatic transverse section of a heterocercal tail during lateral movement.

upper lobe accompanied by a more acute bending of the vertebral column, until in some of the Cretaceous forms the tail was practically homocercal.

Despite differences in proportion, it will be clear that the effectual action of the earlier types (from *Mixosaurus* to *Ichthyosaurus* of the Upper Jurassic) will be that of a reversed heterocercal tail (Type 1 reversed), namely, to drive the tail end of the body downwards—a conclusion reached by Ahlborn (1896). The downward drive of the tail would tend to force the head upwards, were it not for the effect of the action of the fore limbs; the nett result being that the creature swam horizontally.

Ahlborn (1896) suggests that the utility of this arrangement is that it enables a creature lighter than water—due to the presence of lungs and blubber—to swim below the surface of the water in search of the fish which form its food.

In those forms where the tail is effectually homocercal, then the movements of the tail would merely drive the animal forwards, but diving would undoubtedly be made easier by the increased streamlining of the body which has occurred, *pari passu* with the changes in the form of the tail.

REFERENCES.

- AHLBORN, F. 1896. "Ueber die Bedeutung der Heterocerkie und ähnlicher unsymmetrischer Schwanzformen schwimmender Wibelthiere für die Ortsbewegung." Zeit. für Wiss. Zool. Bd. lxi. p. 1.
- BREDER, C. M. 1926. "The Locomotion of Fishes." 'Zoologica,' iv. p. 159.
- GOODRICH, E. S. 1931. 'Studies on the Structure and Development of Vertebrates.' London.
- GRAHAM-KERR, J. 1919. 'Text-Book of Embryology,' ii., Vertebrata. London.
- GRAY, J. 1933. "Studies in Animal Locomotion." Journ. Expr. Biol. x.: i. p. 88; ii. p. 386; iii. p. 391.
- RYDER, J. A. 1886. "On the Origin of Heterocercy and the Evolution of the Fins and Fin Rays of Fishes." Rep. of U.S.A. Commissioner of Fish and Fisheries for 1884, p. 981. Washington.
- SCHMALHAUSEN, J. J. 1913. "Zur Morphologie der unpaaren Flossen." Zeit. für wiss. Zool. Bd. civ. p. 1.
- WATSON, D. M. S. 1935. A private communication.
- WHITEHOUSE, R. H. 1918. "The Evolution of the Caudal Fins of Fishes." Rec. Ind. Mus. xv. p. 135.

XXV.—*On a remarkable Cladoceran.* By FOLKE BORG, D.Sc., Zoological Institute, University of Upsala, Sweden.

[Plate V.]

THE summer of 1934 I spent at the Limnological Laboratory, Aneboda, S. Sweden, studying sedentary animals from the neighbouring lake Stråken. On July 9th a specimen of *Potamogeton perfoliatus* L., just taken from the lake where this plant is very common, was placed in an aquarium in order to see if any Hydræ were fixed upon it. About a dozen Hydræ were found, all belonging to one and the same species, viz., *Pelmatohydra oligactis* (Pallas). On two of these Hydræ a small

rounded elevation was seen on the surface of the animal just below the tentacles. This looked somewhat unusual. A closer examination showed that each elevation was, as a matter of fact, a small Cladoceran, obviously belonging to the Chydoridæ, which was clinging steadily to the Hydra. It was soon established that the Chydorid in question was *Anchistropus emarginatus* G. O. Sars, and that the individuals found were two parthenogenetic females of this species.

Some weeks later (on August 6th) I found on the under side of a leaf of *Nuphar luteum*, growing in the lake, two other Hydræ (*P. oligactis*), one of which had no less than five *Anchistropus* clinging to it. This leaf with its inhabitants I was able to observe in the lake under natural conditions throughout.

Two or three days later, when I had once more brought a specimen of *Potamogeton perfoliatus* from the lake into an aquarium, I found that this specimen was extraordinarily rich in Hydræ, about four hundred of them (all belonging to *P. oligactis*) being fixed upon it. Two of these Hydræ had each an *Anchistropus* clinging to it.

Another specimen of the same plant, transferred into an aquarium on August 16th, was inhabited by about a hundred Hydræ, and of these no less than twelve were carrying one or more specimens of *Anchistropus emarginatus*.

Most of the *Anchistropus*-specimens thus found on different occasions, as well as the Hydræ occupied by them were placed in culture-glasses, where I could thoroughly observe them during several weeks.

As a result, I am able to state that these Cladocerans normally do not quit their host until just before their death.

When an *Anchistropus* was detached from its Hydra (which was not a very easy task), it swam with great speed through the water, mostly in small circles, moving the second pair of antennæ with an extreme swiftness. At intervals the movements of the antennæ ceased abruptly for some moments and the animal sank to the bottom. Soon, however, it equally suddenly started swimming in circles again. If water-plants of different kinds—as, for instance, green algæ, *Lemna*, shoots of *Potamogeton perfoliatus*, *Elodea*, *Myriophyllum alterni-*

florum DC., etc.—were placed in the culture-glass, the small Cladoceran swam swiftly along them or moved about between the stems, leaves, and rootlets, but, as a rule, without fixing itself to any of them. It was only quite seldom, and then only for a few seconds, that it clung to some part of one or other of the plants, before swimming away again.

But if any *Hydræ* were placed in the culture-glass, the behaviour of the Cladocerans was very different, for as soon as an *Anchistropus*, circling about in the water, had arrived in the immediate neighbourhood of a *Hydra*, it instantly attached itself to it and remained there. And if by chance one or two *Hydræ* happened to occur on some of the plants placed in the culture-glass they were soon discovered and occupied by the Cladocerans. Trying as often as I wished, I could not bring an *Anchistropus* to seize hold of any water-plant and remain there longer than a few seconds, whereas the *Hydræ* obviously were an adequate substratum for them. Were no *Hydræ* brought into the culture-glass the small Cladocerans soon died—as a rule, within 24 hours,—quite independent of the occurrence or the lack of water-plants in their culture-glass.

It is easy to observe that *Anchistropus emarginatus* when swimming about shows a positive phototaxis. The behaviour of *Anchistropus* is obviously in this respect quite appropriate, as the *Hydræ*, as is well known, show a positive phototaxis too.

The tentacles of *Pelmatohydra* when fully extended are very long, and therefore it happens frequently that when a swimming *Anchistropus* comes across a *Hydra* it runs against one of its tentacles, to which it then clings (Pl. V. figs. 1, 2). If by any chance it arrives at some other part of the body of the *Hydra*, it fastens itself there in the same way (Pl. V. figs. 2, 3). As a result, one may find the small Cladocerans on very different parts of the surface of the *Hydra*.

The *Anchistropus* fixes itself on to the *Hydra* by means of the two large hooked spines or claws of the first pair of limbs (Pl. V. fig. 1; fig. 4, *k*). Like the claws of a bird of prey they are plunged into the soft ectoderm of the *Hydra* right through it to the mesogloea. As they are directed downwards and at the same time somewhat

inwards and as they further are provided, along the inner rim of their distal portion, with a row of seven or eight pointed strong teeth, they are obviously very well adapted for their purpose.

As may be seen from fig. 4 (Pl. V.) the claw (*k*) has the appearance of being a transformed feathered seta. As such it is hollow. Its wall consists of hard yellow-brown chitin; when approaching the end of the claw it becomes gradually thicker.

The permanent fixation of an *Anchistropus* to the body of a Hydra is managed not only by means of the two large claws of the first pair of limbs but also, to some extent at least, by means of the acute process of the ventral rim of the carapace (Pl. V. figs. 1 & 6; text-fig. 1), which, as we know, is extremely characteristic of *Anchistropus emarginatus* *. This process plays a rôle especially when the Hydra, which obviously is very well aware of the existence of an *Anchistropus* bored into its skin, tries to remove the undesired visitor by partly contracting or by swiftly moving its tentacles or its whole body in different directions. One can see on such occasions that the Cladoceran draws the first pair of limbs towards its body as closely as possible, whereby it is pressed very nearly to the surface of the Hydra. The muscles running between the two halves of the carapace are contracted at the same time, so that the halves of the carapace approach each other, and the acute processes at their ventral rim, the ends of which are turned not only downwards but also a little inwards, are plunged into the ectoderm of the Hydra, thus assisting the animal to hold on to its surface.

I have been able to observe repeatedly under the microscope the process of fixation by an *Anchistropus* to a Hydra, but I have never seen even one of the numerous nematocysts of the Hydra being discharged at them. This is still more remarkable, as many other Cladocerans, for instance small young of *Daphnia pulex*, were instantly captured and very soon paralyzed by the nematocysts. It therefore does not seem quite probable to me that the reason why the nematocysts are not discharged at the *Anchistropus* is simply that the latter are too small.

* The indentation immediately before it (Pl. V. figs. 1 & 6; text-fig. 1) is the cause of the specific name.

Though I am not as yet able to give any other explanation, I may, however, in this connection call attention to the existence of a pair of glands in the two halves of the carapace. The end portion of each of these glands is surrounded by a chitinous network, the meshes of which are pierced by the duct of the gland. As seen in Pl. V. fig. 6, it opens to the exterior at the inner side and immediately below the end of the acute process at the ventral border of the carapace. This is the "shell-gland" of Lilljeborg (1900, p. 588), which name indicates an excretory function; but I am uncertain whether this is correct or not. The possibility should not be overlooked that the gland in question—which so far as is known does not exist or, at all events, has not the same structure in other Chydorids—may have a special function, as, for instance, to paralyze part of the ectoderm of the Hydra so as to prevent the ejaculation of the threads of the nematocysts. I hope to be able soon to return to this problem in another paper.

Anchistropus emarginatus is not only capable of clinging on to any part of the body of a Hydra once for all, but can often be observed making shorter or longer excursions along the surface of it. The mode of motion used is rather curious. When beginning its "walk" the animal withdraws slowly and cautiously one of the two large claws of the first pair of limbs from the soft ectoderm, and plunges it into the ectoderm again at a point a little in advance. The same process is now repeated by the other claw, and so on. This process cannot be termed as either a climbing or a creeping one; it may rather be described as a sort of walking step by step, as if on stilts. So far as I have seen, it is managed by the two large claws of the first pair of limbs exclusively.

When observing, under the microscope, a living *Anchistropus* clinging to a Hydra the five pairs of limbs can be seen, though rather indistinctly, through the carapace. The first pair is fixed in a rather definite position by means of the large claws, deeply inserted in the ectoderm of the Hydra. The second and third pairs of limbs have a somewhat peculiar mode of motion: they are suddenly lifted so that their proximal parts become pressed against the body and are then dropped again. Now they remain motionless for some moments, whereupon the same process

is repeated, and so on. The fourth and fifth pairs of limbs, contrary to those just mentioned, work regularly and automatically. Interrupted by quite short pauses only, they move forwards and back again with a rhythm of about 200-300 strokes a minute, in the same way as most pairs of limbs in, for instance, the Daphnids.

By adding some Indian ink or Carmine to the water, it is easy to see that distinct water-currents are caused by the movements of the fourth and fifth pairs of limbs. A strong current runs from the front in between the two large claws into the space limited by the two halves of the carapace. Another current comes from behind and runs in between the second and third or the third and fourth pairs of limbs into the space just mentioned. From the right and the left, on the other hand, the water cannot, or only to a very slight degree, enter this space, because the rim of the carapace prevents it, being very near the surface of the Hydra and sometimes even pressed against it.

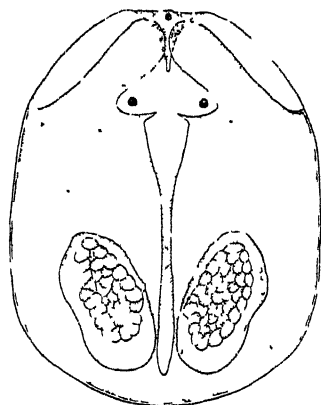
Inside the carapace the currents from in front and behind join to form a single current that is directed upwards. Thus it arrives at the median space enclosed between the proximal portions of the limbs, the "mid-ventral space" (Cannon, 1933, p. 270) or "Filterraum" (Storch, 1924, p. 174). It is brought into this space by the sucking action of the "inter-limb spaces" (Cannon, *l. c.*) or "sucking chambers" (Eriksson, 1934, p. 63) that are formed and disintegrated in a regular order between and according to the rhythmic movements of the fourth and fifth pairs of limbs (*cf.* Cannon, Storch, and Eriksson, *op. cit.*). When the chambers widen, the water is sucked into them, passing thereby through a filter formed by the densely placed setæ of the endopodites of the limbs in question. When, on the other hand, the chambers disintegrate, the water which they contain is forced out backwards through a narrow slit-like passage between the caudal portions of the two halves of the carapace (*cf.* text-fig. 1).

The particles caught on the filter accumulate closely under the ventral side of the animal between the limbs, *i. e.*, in the "median food groove" (Cannon, *l. c.*), and especially in its middle portion, just before the points of insertion of the fourth pair of limbs. From this place

they are transported forwards, that is towards the mouth. This is managed by means of the maxillary processes of the fourth and, above all, the third and second pairs of limbs; whereas the maxillary processes of the first pair of legs are rudimentary and, therefore, play only a very unimportant rôle in this respect.

The movements of the maxillary processes are wholly spontaneous. When a number of particles has accumulated in the shallow groove along the ventral side—the median food groove—this heap will be suddenly seized by the maxillary processes of first the third and then the second pair of limbs, which by one or more

Fig. 1.



Female of *Anchistropus emarginatus* seen from ventral side and from behind, to show outline of carapace. Claws of 1st pair of limbs drawn in optical transverse section. In brood-chamber two embryos. $\times 260$.

quickly repeated movements will bring it to the neighbourhood of the mouth. These movements take place when the limbs in question are, at intervals, suddenly lifted and pressed against the body as described above, and form, consequently, the explanation of this process, which is repeated as often as is necessary. The particles are now seized first by the maxillæ, which form them into a sausage-like body, and then by the mandibles, which masticate them and finally put them into the mouth.

The particles of food captured by *Anchistropus emarginatus* come from different sources. First, we must

assume, I think, that the animal consumes the nanoseston, that is eventually carried into the space between the two halves of the carapace and from there to the mouth. It may be regarded as certain, however, that nanoseston forms only a very inconsiderable part of its food. This is demonstrated, among other things, by the fact that free swimming individuals of *Anchistropus*, not able to find any Hydra upon which to cling, die within 24 hours as a rule, even if they are supplied with fresh water from the lake in which there is a rich amount of nanoseston.

Secondly, just as other Chydorids do, *Anchistropus* can catch particles lying on the surface of its substratum, i. e., in this case the surface of a Hydra. This source of food, however, like the one just mentioned, is of very little importance indeed, because of the fact that only an extremely small amount of detritus can as a rule be found on the surface of a Hydra.

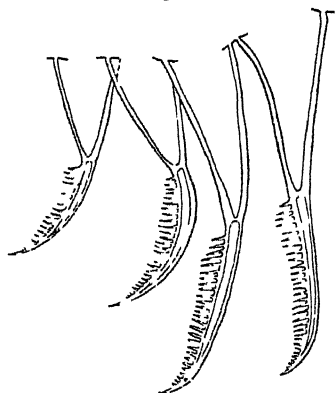
Thirdly, *Anchistropus* takes its food from the Hydra on which it clings, and this source of nutrition is by far the most important one for the animal. When studying a living *Anchistropus* fastened to a Hydra, one is often able to see that the little Cladoceran from time to time presses itself (viz., its ventral side) closely to the surface of the Hydra. This is managed by a bending of the first pair of limbs, which, being fixed into the substratum, by this motion brings the body nearer to it. At the same time the two halves of the carapace are brought nearer to each other, by which the two tooth-like processes at their ventral edge are pressed strongly into the ectoderm of the Hydra. The part of the soft body-wall of the Hydra, situated between the two halves of the carapace is forced upwards, thus forming an elevation in the space between them, as is seen in Pl. V. fig. 5. Now this elevation is attacked by the strong setæ of the endopodites of the second pair of limbs, which are directed towards it obliquely from outwards and upwards (Pl. V. fig. 5). These setæ, whose shape is seen in text-fig. 2, are able by sticking and rasping to detach parts of the ectodermal cells or even whole cells, as I have had an opportunity of observing repeatedly under the microscope. The particles thus detached are instantly caught by the water-current described above, which carries

them to the filters limiting both sides of the mid-ventral space, from whence they are transported to the mouth.

The setæ of the endopodites of the third pair of limbs have the same function as those of the second pair and work in a similar manner, although they are weaker and move obviously with a less amount of energy.

The large claws of the first pair of limbs play an important rôle too, as regards the nutrition from the Hydra. Several times I have been able to see how an *Anchistropus*, having fastened itself to the Hydra by means of one of these claws and the two teeth of the ventral rim of the carapace, has torn the other claw out

Fig. 2.



Setæ from endopodite of 2nd pair of limbs of *Anchistropus emarginatus* (3rd-6th spine from right). Cf. text, p. 297. $\times 830$.

of the ectoderm, then plunged it in again, torn it out, and so on. In this way, by means of the equipment of the strong teeth carried by these claws, ectodermal cells or parts of them are torn off; by the water-current they are instantaneously carried to the filtering apparatus.

As a result of these observations I think we can state that *Anchistropus emarginatus* is not a harmless epibiont only, but that it is a parasite taking its food mostly—nay, almost exclusively—from the Hydra to which it clings. I have not found, however, any severe damage caused by these parasites to the Hydrae, which fact may probably be ascribed to the large capacity for regeneration that is characteristic of Hydra; though, of course,

I cannot deny that such damages may occur under certain circumstances, as, for instance, when a Hydra has happened to be inhabited by a considerable number of *Anchistropus*.

Like most other Chydorids *Anchistropus emarginatus* is monocyclic.

The males are found in the autumn, from September to November; their habits are the same as those of the females.

Females with ephippia occur from about the end of September to the beginning of November, in England possibly even later. The ephippium contains a single egg only.

Parthenogenetic females exist during the whole of the summer. The number of the eggs in the brood-chamber of these females is always two (Pl. V. fig. 2; text-fig. 1). The births take place in most cases at intervals of three or four days. Each birth is followed by an ecdysis. As a rule, the female moults almost immediately after it has borne its two young; but in some cases the ecdysis takes place some hours—nay, sometimes a whole day—after the birth. Because of the steady grip held by the large claws of the first pair of limbs, the empty exuvium at first remains fixed to the ectoderm of the Hydra (Pl. V. fig. 3); later on, but often not until the next day, the grip of the claws gradually loosens and the exuvium finally sinks to the bottom. After each moulting two new eggs soon pass from the ovarium into the brood-chamber; this process occurs, as a rule, within an hour of the ecdysis being finished.

During the whole series of birth and moultings each female normally remains attached to one and the same Hydra, though it often changes its fixation-point on its surface. Only obviously unfavourable conditions of life—as, for instance, lack of oxygen, too high a temperature, etc.—may cause it to detach itself from its Hydra. Swimming about swiftly in circles, it then tries to find another Hydra to cling to. Vigorous shakings of the culture-glass or of the substratum, water-currents directed against the small Cladoceran, etc., do not, on the other hand, detach it from the Hydra.

But when the female has reached the end of its life—which is indicated by the failure, after the last birth,

of an ecdysis and of any migration of new eggs from the ovary to the brood-chamber—it detaches itself voluntarily from the Hydra, swims about swiftly at first, but no more, or for only quite a short time fixes itself to any Hydra or to anything else. It soon sinks to the bottom, which process is repeated frequently, and, finally, after swimming tours that become gradually shorter, it remains at the bottom, lying on one side, and after a few more hours, during which the movements of the limbs become slower and slower, it dies.

The young immediately after their birth fix themselves to the surface of the Hydra at each side of their mother (Pl. V. fig. 3). In most cases they remain immovably at this place until they have finished their first moulting. Their limbs, and especially the fourth and fifth pairs, however, move swiftly and incessantly with the result that already a few hours after the birth the alimentary canals of the young are well stocked with food.

The first moulting takes place, as a rule, on the day after the birth, *i. e.*, after about 24 hours. The young now become more alert, making shorter or longer excursions on the surface of the Hydra. They have now reached—which deserves to be specially mentioned—the stage during which they detach themselves voluntarily from their host in order to find another Hydra on which to cling. I have found, however, that all the young do not start swimming, but only about the half of them. The others during the whole of their life remain fixed to the Hydra on which they were born.

The free-swimming stage of the young *Anchistropus*, if it occurs at all, does not last long. In my cultures the young often fixed themselves after a few minutes, or at most after some hours. If they do not happen to find a Hydra, they soon die; as a matter of fact, in such cases they are found dead already the next day at the bottom of the glass. Sometimes a young is seen to repeat its swimming tour, *i. e.*, after having fixed itself on a Hydra it detaches itself after a short time searching for a new one or fixing itself again on another part of the body of the same Hydra.

The second moulting occurs two or sometimes three days after the first one. As soon as an animal has performed this ecdysis, two eggs for the first time pass from the

ovary into the brood-chamber. The primipara-stage thus coincides with the third stage of postembryonic development. I have found no exception from this rule.

The first birth and, accordingly, the third ecdysis I have found to occur in by far the most cases after further three days. The series of moultings following take place likewise, as a rule, at intervals of three or sometimes four days.

The new-born young of *Anchistropus emarginatus* measure in length 0.17 mm. on an average. After the first ecdysis they measure 0.20 mm., thus having increased about 18 per cent. in length. The primiparae measure 0.24 mm. on an average, the augmentation in length from the second to the third postembryonic stage thus amounting to 20 per cent. The largest (parthenogenetic) female that I have measured was 0.44 mm. in length, which makes it certain that this specimen had passed through numerous moultings.

The males are a little smaller than the females. They measure 0.37–0.39 mm. in length.

The new-born young are almost colourless and, therefore, quite transparent. After the first ecdysis they have acquired a light yellowish colour, and are, moreover, characterized by a dark spot on each side of the ventral part of the carapace, a little behind the middle portion of the animal. In the primipara stage the young *Anchistropus* finally shows the typical coloration of a full-grown individual. Its colour now is yellow as honey, but for a tinge of grey, and the dark spot just mentioned has been transformed into an extremely characteristic dark brownish or almost black band running from below obliquely upwards and backwards in the posterior ventral part of the carapace (Pl. V. fig. 3). On the very end of the carapace only there remains a quite small area tinted a greyish yellow like the rest of the carapace (Pl. V. fig. 3). As the animals grow older they become somewhat darker on the whole.

The colour of the males is the same as that of the females.

The distribution of *Anchistropus emarginatus*, so far as hitherto known, shows a very obvious discontinuity.

Most localities are situated in the northern part of Europe, *i. e.*, in Norway, where it was detected in 1862 by G. O. Sars, further in Sweden, Denmark, Finland (one locality), Lettland, Poland, and North Germany. In Switzerland some localities are known, whereas, on the other hand, the species has not yet been found in South Germany nor in Austria, France, Belgium, or the Netherlands.

As for Great Britain and Ireland, so far as I am aware, *Anchistropus emarginatus* has been reported from one locality only in England (one of the water-reservoirs of the East London waterworks at Walthamstow (Scourfield, 1903, p. 446)), from one in Scotland (Paisley Canal near Glasgow (Normann & Brady, 1867, p. 55)), and from two in Ireland (Belle-isle, Upper Lough Erne, and Castle Archdale, Lower Lough Erne (Kane, 1907, p. 307)). As these finds were all made rather a good many years ago, I wrote to Dr. Isabella Gordon, at the British Museum (Nat. Hist.), asking if there was any further material of *Anchistropus emarginatus* in the Museum. Dr. Gordon kindly answered me that this was not the case, and that the only British material of this Crustacean in the Museum was from Paisley Canal, Scotland, and Upper Lough Erne, Ireland.

It is extremely characteristic of *Anchistropus emarginatus* that almost without exception it has been found, in each locality, in only one or two or in any case in quite a few individuals. No wonder, therefore, that it was generally thought to be very rare; by Scourfield (*l. c.*), for instance, it was considered as "one of the rarest of all the British Cladocera."

The apparent discontinuity of the distribution of *Anchistropus emarginatus* as well as its markedly sporadic occurrence are both explained, however, in my opinion by the singular habits of this Cladoceran as described above. Evidently the animals, because they are normally fixed on a Hydra, are very seldom caught in a net. In reality, the occurrence of *Anchistropus* according to my results is not sporadic at all nor may its distribution show any obvious discontinuity. It is necessary, however, to search for it in quite another way and also at other places than hitherto. I am of the opinion that this, the first parasitic Cladoceran known, will soon be found to be much more common than was thought.

A more thorough description of the morphology and ecology of *Anchistropus emarginatus* will be found in another paper by the author (Borg, 1935) soon to be issued.

LITERATURE.

- BERG, K. 1929. "A Faunistic and Biological Study of Danish Cladocera." Vidensk. Medd. Dansk Naturh. Foren. Kjøb. 88.
- BORG, F. 1935. "Zur Kenntniss der Cladoceren-Gattung *Anchistropus*." Zool. Bidr., Uppsala, Bd. 15.
- CANNON, H. G. 1933. "On the Feeding Mechanism of the Branchiopoda." Phil. Trans. R. Soc. London, ser. B, vol. cccxii.
- ERIKSSON, S. 1934. "Studien über die Fangapparate der Branchiopoden." Zool. Bidr., Uppsala, Bd. 15.
- FRANKE, H. 1925. "Der Fangapparat von *Chydorus sphaericus*." Zs. wiss. Zool., Leipzig, Bd. 125.
- KANE, W. F. DE V. 1907. "Additional Records of Fresh-water Entomostraca in Ireland." 'The Irish Naturalist,' vol. xvi.
- LILLJEBORG, W. 1900. 'Cladocera Sueciæ.' Uppsala.
- NORMAN, A. M., & BRADY, G. S. 1867. 'A Monograph of the British Entomostraca.' London.
- SARS, G. O. 1862. "Oversigt af de i Omegnen af Christiania iagttagne Crustacea Cladocera." Vid. Selsk. Forhandl. Jg. 1861.
- SCOURFIELD, D. J. 1903. "Synopsis of the known Species of British Freshwater Entomostraca.—I. Cladocera." J. Quekett Micr. Club, (2) vol. viii.
- STORCH, O. 1924. "Morphologie und Physiologie des Fangapparates der Daphniden." Ergebn. Zool. Jena. Bd. 6.

EXPLANATION OF PLATE V.

Anchistropus emarginatus G. O. Sars.

The figs. 1-3 are photomicrographs of living animals.

- Fig. 1. Young (in second stage) clinging to tentacle of *Pelmatohydra oligactis*. Large claw of left limb of the first pair and tooth-like process of right half of carapace are clearly distinguishable. $\times 70$.
- Fig. 2. Specimen of *Pelmatohydra oligactis* seen from one side. Just under the tentacles two *Anchistropus*-females, the one to the left with two embryos in its brood-chamber. On the tentacle to the right a small young (in second stage). $\times 15$.
- Fig. 3. Another specimen of *Pelmatohydra oligactis* seen from one side. On the Hydra a female of *Anchistropus emarginatus* which about two hours ago bore two young (one is visible) and a few minutes before it was photographed moulted. The empty skin (between mother and young) still fixed to the Hydra. $\times 25$.
- Fig. 4. First (left) limb seen from the outer side. After Lilljeborg. k, large claw. $\times 310$.
- Fig. 5. Female fixed on surface of a Hydra as seen from front and illustrating mode of nutrition from Hydra. $\times 130$.
- Fig. 6. Part of carapace seen from inner side and showing chitinous network of "shell-gland" opening at top of tooth-like process, $\times 150$.

XXVI.—On *Tomognathus*, a Teleostean Fish from the English Chalk. By Sir ARTHUR SMITH WOODWARD, F.R.S.

[Plate VI.]

IN 1908 * I described the skull and other remains of a fish, *Tomognathus mordax*, which seemed to be related to the Stomiatidæ and their allies at present existing at considerable depths in the oceans. I am now indebted to Dr. Sidney Spokes, of Lewes, for the opportunity of studying another specimen of *Tomognathus* which exhibits some new features; and as the osteology of the Stomioid fishes has been described during recent years †, it is at last possible to compare the fossil with some of the existing genera. The new specimen was found in the neighbourhood of Lewes, and the matrix seems to show that it was obtained from the Lower Chalk, probably the zone of *Holaster subglobosus*.

The fossil exhibits the head and opercular apparatus, with parts of the dorsal and pectoral fins, and is shown about two-thirds nat. size in Pl. VI. fig. 1, with a right side view of the head, nat. size, in fig. 2. The left side of the head and the snout were much damaged by the fracture which originally revealed the fossil, but the right side of the head and the dorsal fin have been carefully exposed by removal of the matrix.

The skull of *Tomognathus* is seen to differ from the known skulls of Stomioids in the relatively great length of the occipital region and the extent of the well-developed median crest on the supraoccipital bone. It also differs in the relatively large size of the parietal bones, which are seen to flank the supraoccipital throughout its length. The epiotics, which are so prominent in the Stomioids, have not been observed. The parietals are nearly smooth, but the thickened frontals in the new specimen are of loose texture as already described. Traces of the downwardly-directed elongated superficial bone, of which the triangular base seems to cover the sphenotic region, are observable on each side.

* A. S. Woodward, 'Fossil Fishes of the English Chalk' (Palæont. Soc., 1902-12), p. 139, pl. xxix. figs. 3-13.

† C. T. Regan and E. Trewavas, "The Fishes of the Families Stomioidæ and Malacosteidæ," Danish 'Dana' Expeditions, 1920-22, Oceanographical Report, no. 6 (1930).

I formerly named this bone "a supraorbital." The hyomandibular, as usual, is strengthened by a vertical ridge along the middle of its outer face. The thin laminar entopterygoid is a little displaced on the right, and a fragment of the toothed ectopterygoid is seen on the left side. The greater part of the right maxilla is well preserved, and its triangular expansion behind is marked by a few tubercles, each pitted at the apex. It is interesting as bearing a single large supramaxilla, which tapers forwards. This bone has not previously been seen. There is nothing new in the mandible, so far as it is shown.

The opercular bones are well preserved in their natural position on the right side. The narrow smooth preoperculum seems to be continued forwards into a very short lower limb. The greater part of the outer face of the operculum and suboperculum is covered by small pittings, which are often situated on the apices of tubercles; and there is a smooth depression on the upper part of the operculum and on the front border both of this bone and of the suboperculum, which suggests the presence of a well-developed slime-system. The smooth uppermost branchiostegal ray is relatively large, as already shown in other specimens; fragments of slender branchiostegal rays remain below the front end of the angular bone of the mandible. Above the operculum is a well-developed elongate-triangular post-temporal bone, which tapers upwards.

Fragments of the pectoral fins are preserved at the lower border of the fish, where they have already been seen in other specimens. The remains of the dorsal fin, however, are so far unique. This fin, which is shown to comprise not less than forty stout smooth rays, extends continuously along the back from a point just behind the head, and the length of the longest ray is at least equal to the length of the head. In each ray a long basal portion is unjointed, and the inserted end is produced backwards into a little sharp point. In several rays the beginning of jointing is seen distally, but the loose divided portions are broken away.

Although the dorsal fin is evidently in its natural position, there are no traces of its supports or of any

internal bones of the trunk. Some fragments just behind the head seem to be bits of dorsal fin-rays. A small, presumably young, example of *Tomognathus* discovered by Mr. G. E. Dibley, has already shown that the bones of the trunk were imperfectly ossified and that the vertebral centra, if present, were incapable of preservation. The new specimen now described may therefore indicate that imperfect ossification of the vertebral axis was a characteristic of *Tomognathus*. If so, it is interesting to note that vertebral centra are often lacking in the front half of the axis of the existing Stomiatoids; and a feature which might at first appear to be a late specialisation is really one of great antiquity.

EXPLANATION OF PLATE VI.

Tomognathus mordax Dixon; head with dorsal fin and part of pectoral fin in right side view, about two-thirds nat. size (1), and head, nat. size (2).—Lower Chalk; Lewes, Sussex.

XXVII.—On a Female of *Troides victoriæ regis* with Male Coloration. By Lord ROTHSCHILD, F.R.S.

THIS extraordinary insect was sent to me by the Rev. Père Poncelet, and is evidently due to some form of shock during its preliminary stages.

The wings are crumpled in several places, and although these wings are about the size of those of a normal ♂, they fall far short of those of a normal ♀, the crumpling is most apparent in the basal half of the fore wings. The abdomen is distinctly ♀. The ground-colour is black, NOT brown as in the ♀. The shape of the wings is intermediate between that of the ♂ and ♀ of *T. victoriæ regis*, but more like the ♂. The green of the basal fourth of fore wing of normal ♂ *T. v. regis* is much reduced in this ♀, and in the cell irregularly replaced by black; the white spots however, in the cell of the ♀ fore wing are replaced by green. The subapical ♂ green patch is much reduced and the green colour surrounds three golden-yellow spots. Hind wings have the discal band of white patches of the normal ♀ replaced by golden-yellow patches, edged with metallic-green, the yellow submarginal spots of the

normal ♂ have only narrow edges of green; the subcostal area green, as also are some marks in the cell. Below the pattern is similar, but the cell-patch of fore wing and the subapical patch are more extended.

Hab. Buin, Bougainville.

I name this ♀ f. *ponceleti* after its captor.

XXVIII.—*Papers on Oriental Carabidæ*.—XXIX.

By H. E. ANDREWES.

Two or three years ago I described a number of new species from Sumatra, and a little later on I published a Catalogue of the *Carabidæ* of that island. I have lately been examining some collections from the neighbouring island of Java, and describe here thirteen new species collected during recent years by Mr. C. J. Louwerens, of Toeloengagoeng, who has kindly allowed me to retain the type-specimens in my collection. Four of these new species belong respectively to the genera *Siagona*, *Dyschirius*, *Microlestes*, and *Platytarus*, all new, not only to Java but to the Malay Archipelago.

Siagona insulana, sp. n.

Length 13 mm.

Piceous, tibiæ at middle and labial palpi reddish. Body winged, pubescent.

Head moderately convex, clypeus rather deeply emarginate, clypeal suture very fine, lateral ridges fine, uninterrupted, rounded at the bend, not quite reaching the deep neck constriction; surface rather finely and sparsely punctate, vertex and neck smooth and impunctate, the neck constriction deep; mandibles small, dilated at base, supramaxillary plates inconspicuous, eyes small, hemispherical, antennæ nearly reaching middle of elytra, joint 1 slender at base, strongly dilated at apex. *Prothorax* cyathiform, convex at sides, a fourth wider than head and a third wider than long, the sides rather gently rounded in front; median line short and fine, lateral grooves moderately deep, uninterrupted, puncturation fine and only moderately close, much more sparse on disk. *Elytra* flat, elongate-oval, though with evident shoulders and nearly straight sides, barely wider than prothorax, twice as long as wide, surface moderately

and fairly closely punctate, suture raised, humeral ridge obsolete, the pores at base visible, but those along sides hardly distinguishable from the general puncturation. A faint isodiametric microsculpture is visible on the elytra. No stridulatory apparatus.

Of the same size as and nearly allied to *S. fabricii* Andr., but more finely punctate throughout. The first joint of the antennæ is shorter and dilated more gradually from about basal third, the lateral grooves on the prothorax are uninterrupted and rather shallower, the elytra longer, with straighter sides and squarer shoulders.

Res. KEDIRI: TJAMPOER-DARAT, 1 ex. A second specimen from the Bowring Collection in the British Museum is labelled "Java" only.

Clivina ateuches, sp. n.

Length 4.3 mm.

Black, shiny; palpi and tarsi pale ferruginous.

Head wide, with prominent eyes; median part of clypeus depressed and truncate in front, but not bordered, wings on the same level, rounded, separated on each side from the median part by a slight notch; frontal plates small, convex, externally rounded; clypeal suture and lateral impressions both deep, facial sulci short, shallow, and oblique, neck constriction fairly deep, formed by a row of punctures; mandibles short and not very sharp, labrum 7-setose, antennæ moniliform, joint 2 hardly longer than 3. *Prothorax* strongly convex, a fourth wider than head and as much wider than long, widest at middle, sides and front angles rounded, hind angles shortly dentate; median line and front transverse sulcus both fairly deep, ends of the latter reaching margin, surface finely wrinkled and punctate on each side of disk. *Elytra* convex, a fifth wider than prothorax, three-fourths longer than wide, with slightly rounded sides; striæ moderately deep and finely punctate, 1 to 3 free at base, 4 joining 5, 6 and 7 ending rather further back, but 4 to 7 all converging on shoulder, striae fairly long; intervals convex, 3 with four clearly marked equally spaced pores on the interval but very near stria 3, 8 carinate at extremities, rounding the shoulder in front and ending at the base of stria 5. No appreciable microsculpture except for some faint isodiametric meshes on

front of head. Sternum impunctate, prosternal ridge not very narrow, faintly sulcate behind and with a pore in front. Venter impunctate, apical segment with the two pores on each side close together. Protibiæ without sulcus, tridenticulate; mesotibiæ narrow, without spur.

Very near *C. tranquebarica* Bon., but the base of the antennæ and the meso- and metatibiæ are black, the facial sulci are very slight, and no facial carinæ are present, so that the head has quite a different appearance.

TOELOENGAGOENG, 1 ex.

Dyschirius rugifrons, sp. n.

Length 3.4 mm.

Brassy, very shiny; buccal organs, joints 1 and 2 of antennæ, with the base of joints 3 and 4, lateral margins of elytra towards apex, meso- and metatibiæ, and all tarsi ferruginous, protibiæ and femora brown.

Head with the clypeus convex, bisinuate in front, the median part a little advanced, the lateral teeth rounded at apex, projecting some little way beyond it, clypeal suture deep, facial sulci long and very deep, wide and rugose in front, diverging behind, front covered with transverse rugæ, some slight striation behind across the vertex, surface otherwise smooth. *Prothorax* globose, a third wider than head, but very little wider than long, border entire to hind lateral pore; median line moderately deep in front, widening out and very deep behind, transverse impression moderately deep, crenulate. *Elytra* ovate, with square shoulders, slightly depressed behind base, which is unbordered, a third wider than prothorax, three-fourths longer than wide; striæ fairly deep in front, but shallower towards apex, coarsely punctate on basal half, but the punctures nearly disappear behind, 1 a little deeper than the rest, arising in a basal pore, 8 shallower than the other striæ, commencing a long way behind shoulder, and interrupted for some little distance behind, two apical and three posthumeral pores; intervals convex, 1 somewhat raised, 3 with five pores on the interval. No microsculpture. Protibiæ with the upper spine obsolete, the lower one small and not very sharp, the apical digitation longer than the spur.

Closely allied to *D. nitens* Putz., but a larger insect, with transverse rugæ on the head, the elytra relatively

longer, interval 3 with five instead of three dorsal pores.

TOELOENGAGOENG, 1 ex.

Tachys prionotus, sp. n.

Length 1.8 mm.

Ferruginous, a vague cloud on the disk of the elytra behind.

Head convex, wide, frontal furrows small but distinctly impressed, mentum with two pores, eyes small, not prominent, shortly setulose, antennæ fairly long though moniliform, joint 2 a little longer than 3. *Prothorax* convex, cordate, a little wider than head and a third wider than long, base barely wider than apex, its sides slightly oblique, sides bisetose, rounded in front and vaguely sinuate behind, the hind angles slightly obtuse though fairly sharp, without carina; median line and front transverse impression both very fine, basal sulcus moderately deep, not crenulate, its sides running forward to form an obtuse angle at middle. *Elytra* moderately convex, subovate, though with distinct shoulders, nearly a half wider than prothorax, a half longer than wide, border minutely dentate and setulose, forming a very sharp angle at shoulder and extending inwards and backwards for some little distance on each side beyond hind angles of prothorax; stria 1 impunctate, lightly impressed and not reaching base, the other striæ just traceable here and there, 8 visible near apex, surface smooth and shiny, apical striole short but distinct, on middle of elytron, the pore far back near apex; dorsal pores small but distinct, on the site of stria 3, at about two-fifths and four-fifths. Microsculpture of the elytra formed by extremely fine transverse lines, practically none on head or prothorax.

Very close to *T. ochrias* Andr. and similar in form, but ferruginous in colour, the elytra without dark border or suture. The hind angles of the prothorax are sharper and almost rectangular, the basal border of the elytra makes a much sharper angle at shoulder and then bends backwards, the hind dorsal pore, which in *ochrias* is as far distant from the striole as the latter is long, is here only half that distance.

TOELOENGAGOENG, 2 ex.

Tachys particula, sp. n.

Length 1.4 mm.

Ferruginous, the elytra vaguely darker at base and sides, the prothorax lighter on its basal two-thirds.

Head convex, frontal furrows small but fairly deep, mentum with two pores, eyes not prominent, hardly appreciably setulose, antennæ moniliform, joint 2 much longer than 3. *Prothorax* cordate, a fourth wider than head, a third wider than long, base as wide as apex, otherwise similar to *prionotus*. *Elytra* as in *prionotus*, but they are only a third wider than prothorax and less than a half longer than wide, while the basal border bends only slightly backwards; stria 1 is similar, but the other striae are hardly traceable, though 2 and 8 are just visible near apex, and there is no apical stria; the dorsal pores are similar, but the surface is slightly setulose near apex. Microsculpture similar, fine but quite distinct on the elytra, faint but visible on the head and sides of the prothorax.

Closely allied to *T. microscopicus* Bates, but flatter and lighter in colour, the elytra longer, flatter, and with less parallel sides, the microsculpture on the head formed by strongly transverse instead of isodiametric meshes.

TOELOENGAGOENG, 1 ex.

Chlænius louwerensi, sp. n.

Length 20–21 mm.; width 7.5–8 mm.

Black, moderately shiny; head æneous on disk, greenish at sides, prothorax with an æneous tinge, joint 1 of palpi, joints 1 to 3 of antennæ, epipleura, border, and interval 9 of elytra, and legs ferruginous, the femora and front legs paler, the metatarsi darker, rest of palpi and antennæ brown. Surface sparsely pubescent.

Head rather small, frontal furrows slight, each containing a few punctures, surface finely strigose-punctate, some larger punctures at sides and across vertex, eyes prominent, labrum truncate, palpi slender, antennæ reaching basal third of elytra, joint 3 rather longer than 4, tooth of mentum bifid. *Prothorax* moderately convex, subcordate, a third wider than head, a sixth wider than long, base wider than apex, slightly emarginate at middle, its sides very oblique close to the angles, sides with a

narrow border, sparsely setulose, rounded in front, faintly sinuate behind, a seta on each side at a sixth from base, hind angles a little obtuse and rounded; median line fine, not nearly reaching extremities, basal foveæ not very deep, linear at bottom, surface closely and minutely strigose-punctate, the base more densely, with larger scattered punctures. *Elytra* convex, ovate, but the shoulders, though rounded, are quite distinct, fully a half wider than prothorax, three-fifths longer than wide, border with a sharp though obtuse angle at shoulder; striæ fine and fairly deep, minutely punctate, intervals convex, each with a row of punctures on each side, adjoining the striæ, 8, 9, and the marginal channel fairly densely punctate, the golden pubescence quite noticeable along the sides of the striæ, especially near apex. Microsculpture formed by fine isodiametric meshes, quite distinct on the elytra, rather faint on the prothorax, none on the head. Sterna moderately punctate; prosternal process unbordered, the declivity pilose; metepisterna a little longer than wide, not outwardly sulcate; profemora in the ♂ not dentate; the dilated joints of the ♂ protarsi a little longer than wide, sparsely pubescent. Venter finely punctate, very finely and sparsely along the median line.

Not at all unlike *C. nigricans* Wied., and similar in colour, though a little smaller, the punctures on the upper surface much less numerous, both head and prothorax finely and closely strigose-punctate, the prothorax wider, with more rounded hind angles, the basal foveæ narrower and shallower; the elytral intervals a little less convex.

TOELOENGAGOENG, 1 ex. ♂; Res. KEDIRI, MODJOPANGGOENG, 1 ex., ♀.

Badister caviceps, sp. n.

Length 5.5 mm.

Black, the elytra with a vague greenish tint and slightly iridescent; buccal organs, joint 1 of antennæ, lateral margins of prothorax and elytra (both rather narrowly), and underside more or less ferruginous, legs paler, almost flavous.

Head wide, clypeus bordered in front and deeply emarginate, the emargination semicircular, the whole front half of the head depressed to form a kind of crater,

semicircular in outline behind, labrum bifid, with a deep narrow notch between the two parts, eyes moderately prominent, maxillary palpi slender, apical joint rather pointed at apex and hollowed out on the inner side, last joint of labial palpi securiform, setulose, its apex very oblique and with a minute process at its extremity, resembling, though much smaller than, the subulate apical joint of the palpi in *Bembidion*. *Prothorax* moderately convex, slightly wider than head, three-fourths wider than long, base arcuate, hardly wider than apex, which is emarginate and bordered, sides bisetose, rounded in front, straight behind, the hind angles obtuse, reflexed, and rounded, though quite evident; median line at middle and basal foveæ moderately deep, the other impressions slight, surface smooth, very slightly rugose-striate on the basal area. *Elytra* convex, ovate, but with well-marked shoulders, two-fifths wider than prothorax, three-fifths longer than wide; striae moderately impressed, impunctate, intervals slightly convex, two dorsal pores on 3, adjoining stria 2, surface smooth and impunctate. Microsculpture of the head and sides of prothorax formed by isodiametric meshes; on disk of prothorax and elytra it consists of very closely placed transverse lines. Under-side smooth and impunctate.

Apart from the large and curiously formed head the species is almost exactly like *B. sundaicus* Andr., though in the new species the prothorax is a little wider and the elytral striae slightly deeper. There is, however, no question here of sexual dimorphism, for in *sundaicus* the head is similar in the two sexes.

TOELOENGAGOENG, 1 ex., ♀.

Chlæminus tetrastictus, sp. n.

Length 7.5 mm.

Black; palpi, joints 1 and 2 of antennæ (rest brown), legs, and two rounded spots on each elytron ferruginous; the front spot behind shoulder extends from stria 4 to stria 8, the apical spot from stria 3 to stria 8. Body sparsely and shortly pubescent.

Head smooth, with prominent eyes, frontal furrows short and deep, diverging strongly behind, antennæ stout, extending well beyond base of elytra. *Prothorax* convex, cordate, a half wider than head, not very much

wider than long, base slightly arcuate, as wide as apex, sides strongly rounded, bisetose, with a narrow reflexed border, hind angles projecting on each side as a small rectangular tooth; median line very fine, deep close to base, basal foveæ deep, linear, surface sparsely and minutely punctate, basal area more closely and coarsely. *Elytra* convex, ovate, but with square shoulders, a third wider than prothorax, two-thirds longer than wide; striæ deep, minutely crenulate, intervals finely but not very closely punctate, the punctures though irregular running to some extent in longitudinal lines, especially close to the striæ, no dorsal pores evident. A micro-sculpture of fine transverse lines is just visible on the prothorax and elytra; on the head there are fairly distinct isodiametric meshes. Underside very sparsely pubescent, last ventral segment with one marginal seta on each side in the ♂, two in the ♀.

A little larger than *C. biplagiatus* Motch., and with two spots on each elytron, the head with more prominent eyes and deeper frontal furrows; the puncturation of the elytra is very similar in the two species and quite different from the close puncturation of *C. biguttatus* Motch.

TOELOENGAGOENG, 2 ex., ♂♀.

Abacetus furax, sp. n.

Length 5-6 mm.

Black, upper surface dark æneous; palpi, joints 1 and 2 of antennæ, and legs ferruginous, but the extremities of the tibiæ and a great part of the femora are often piceous.

Head convex, smooth, eyes fairly prominent, frontal impressions moderately deep, diverging but curving slightly inwards behind, antennæ extending a little beyond base of elytra. *Prothorax* convex, cordate, fully a half wider than head, about a fourth wider than long, base evidently wider than apex, sides bisetose, narrowly bordered, well rounded in front, practically straight behind, the small obtuse hind angles not projecting laterally, the large pore actually on the angle; median line very fine, only slightly deeper before base, transverse impressions obsolete, basal foveæ linear and fairly deep, converging slightly in front, base very narrowly bordered on each side between them and the lateral channels,

surface smooth, but very finely punctate between the foveæ. *Elytra* convex, with parallel sides and square shoulders, about a fourth wider than prothorax, three-fifths longer than wide; striae fairly deep, shallower towards apex, impunctate, 2 arising in an umbilicate pore; intervals moderately convex, a single dorsal pore on each side, adjoining stria 2, placed a little before middle, surface smooth. Microsculpture of the head and elytra isodiametric and distinct; on the prothorax the meshes are somewhat wider than long and on the disk not very clearly defined. Underside smooth, prosternum sulcate, both pro- and metasternal processes bordered, the former at apex only; metepisterna a half longer than wide; metatarsi not sulcate, claw-joint without setæ beneath.

Allied to *politulus* Chaud. and very similar in colour, though the legs are much darker; prothorax narrower, hind angles not projecting laterally, median line hardly deeper towards base, which bears more punctures between the foveæ.

TOELOENGAGOENG, 8 ex.

Colliuris cyanauges, sp. n.

Length 6.25 mm.

Black, elytra blue-black; palpi (except apical joint), joints 1 to 3 of antennæ, and legs ferruginous; apical joint of palpi, apex of tarsal joint 5, and apical fourth of elytra brown, the elytra in addition each with an oblique ferruginous spot, not quite reaching either apex or suture.

Head convex, shiny, eyes rather flat, genæ longer than eyes and curving back to the narrow neck constriction, frontal impressions deep, foveiform, antennæ extending very little beyond base of elytra, surface moderately and fairly closely punctate, the punctures extending backwards well beyond the hind-eye level, but leaving the clypeus and the back of the head smooth, underside with two irregular lines of punctures. *Prothorax* sub-cylindrical, narrower than head, very nearly a half longer than wide, widest behind middle, rather suddenly contracted but hardly constricted at basal fifth, lateral borders obsolete; median line just visible, surface rather closely and coarsely punctate both above and beneath.

Elytra moderately convex, a little more than twice as wide as prothorax, three-fourths longer than wide, shoulders rather square, sides nearly parallel, apex slightly truncate; striæ deep and coarsely punctate, but both striæ and punctures are shallower behind, intervals convex, 7 and 8 raised to form a small boss on each side a little before apex, 3 with three fairly conspicuous setiferous pores, another small one quite close to base at the point on which striæ 1 and 2 converge. No microsculpture. Sterna closely punctate, middle of metasternum and venter impunctate.

Very near *C. litura* Schm. Goeb. and similarly marked, but the elytra have a distinctly bluish tinge; the puncturation of the head is less coarse, the genæ less convex, the puncturation of the head is less coarse, the genæ less convex, the prothorax evidently shorter and less dilated at middle, the elytral striæ not quite so deep.

Residency SEMARANG : AMBARAWA, 5 ex.

Zuphium trigemme, sp. n.

Length 8-9 mm.

Piceous; buccal organs, antennæ, legs, a spot on the front half of each elytron on intervals 3 to 5 and a common spot at apex on intervals 1 and 2 more or less ferruginous, apex of palpi and joint 1 of antennæ except at extremities infusate; surface rather dull, finely pubescent.

Head flat in front, convex behind, eyes flat, genæ curving round sharply to the narrow constricted neck, surface finely and not very closely punctate. *Prothorax* cordate, rather flat, a little wider than head and a little longer than wide, base as wide as apex, its sides oblique, front angles rounded, sides very narrowly bordered, gently rounded in front, sinuate a little before base, hind angles right though a little rounded, reflexed, and projecting a little laterally; median line extremely fine, basal foveæ moderately impressed, surface very finely punctate in front, a little more coarsely along the sides and in the foveæ. *Elytra* flat, sides nearly parallel, shoulders rounded, apex truncate, three-fourths wider than prothorax, rather more than a half longer than wide; striæ shallow, vaguely punctate, intervals slightly punctate, surface finely and closely asperate-punctate. A microsculpture of very fine transverse lines is visible between the punctures and

asperities on the prothorax and elytra, but not on the head.

Of the same size as *Z. bimaculatum* Schm.-Goeb., but the apex of the palpi and joint 1 of the antennæ are infuscate, the front elytral spot is on the disk instead of behind the shoulder, and there is also a common apical spot; the general form is narrower, the head and prothorax are both more finely and closely punctate, while the elytra, though quite as closely, are a little less distinctly punctate.

TOELOENGAGOENG, 2 ex.

Microlestes ater, sp. n.

Length 3.5 mm.

Black, dull, elytra sometimes with a vague æneous tinge; palpi, base of antennæ, and tarsi more or less piceous. Body winged.

Head smooth, microscopically punctate, a slight fine line at each end of the clypeal suture, eyes moderately prominent. *Prothorax* moderately convex, barely wider than head, a sixth wider than long, base as wide as apex, produced at middle and emarginate at sides, sides gently rounded in front, straight behind, hind angles slightly obtuse and only moderately sharp; median line short but fairly deep, the other impressions obsolete, surface with a few microscopical punctures. *Elytra* rather flat, with nearly parallel sides, apex truncate, two-thirds wider than prothorax, slightly more than a half longer than wide; striæ impunctate, barely impressed though nearly all visible, 1 and 2 arising in an umbilicate pore, intervals flat, 3 with two almost invisible dorsal pores at about a third and three-fourths. Microsculpture very distinct, consisting of very wide meshes on the prothorax and elytra, isodiametric meshes on the head. Last ventral segment similar in the two sexes, the abdomen largely exposed; claws with two or three teeth on each part.

Slightly larger than *M. inconspicuus* Schm. Goeb. and dull black, with only the vaguest æneous tinge, the elytra rather more convex, hardly dilated behind, and with a much less shiny surface.

TOELOENGAGOENG, 4 ex.; Res. KEDIRI, TJAMPOER-DARAT, 1 ex.

Platytarus compsus, sp. n.

Length 7 mm.

Black, dull; buccal organs, antennæ, legs, margins of prothorax and elytra and of ventral segments ferruginous.

Head flat, eyes moderately prominent but embedded behind in genæ, which are as long as eyes, both covered with short erect hairs, neck moderately constricted, antennæ extending little beyond base of prothorax, paragenæ visible from above, surface densely longitudinally striate, neck finely and closely punctate. *Prothorax* rather flat, subcordate, a fifth wider than head, only just wider than long, widest a little behind front angles, base a little narrower than apex, strongly produced at middle, the sides a little oblique, apex somewhat emarginate, the front angles rounded, sides gently rounded to the hind angles, the border finely and irregularly crenulate, minutely setulose, a single seta on the right side about middle (perhaps abnormal, for the usual lateral pores are present near hind angle and at a fourth from apex), hind angles projecting a little on each side as a small sharp tooth; median line fine but clearly impressed, extending from base to apex, surface finely and densely rugose-punctate. *Elytra* rather flat, oval, three-fifths wider than prothorax, three-fourths longer than wide, widest at a little behind middle, base deeply emarginate at middle to receive the produced part of the base of prothorax, apex truncate and slightly bi-emarginate, border setulose but not denticulate; striæ fine and finely punctate, intervals 1, 3, and 5 slightly raised, inner margin of 8 carinate, the carina uninterrupted, surface microscopically punctulate. Underside microscopically granulate, metasternum and venter sparsely setulose; claws with three fairly conspicuous teeth at the middle of each half.

Very similar in size and colour to *P. boysi* Chaud., but without the red shoulder-spot on the elytra (though this is rather a variable character). Head more coarsely striate, the genæ more conspicuous; prothorax wider, the middle of base more produced, the apex a little more deeply emarginate; the elytra almost exactly similar.

TOELOENGAGOENG, 2 ex.

XXIX.—A rare Parasite of the Family Monorchidæ Odhner, 1911, from an Indian Freshwater Fish (*Ophiocephalus punctatus*) *. By HAR DAYAL SRIVASTAVA, M.Sc., Lady Tata Research Scholar, Zoology Department, University of Allahabad, India.

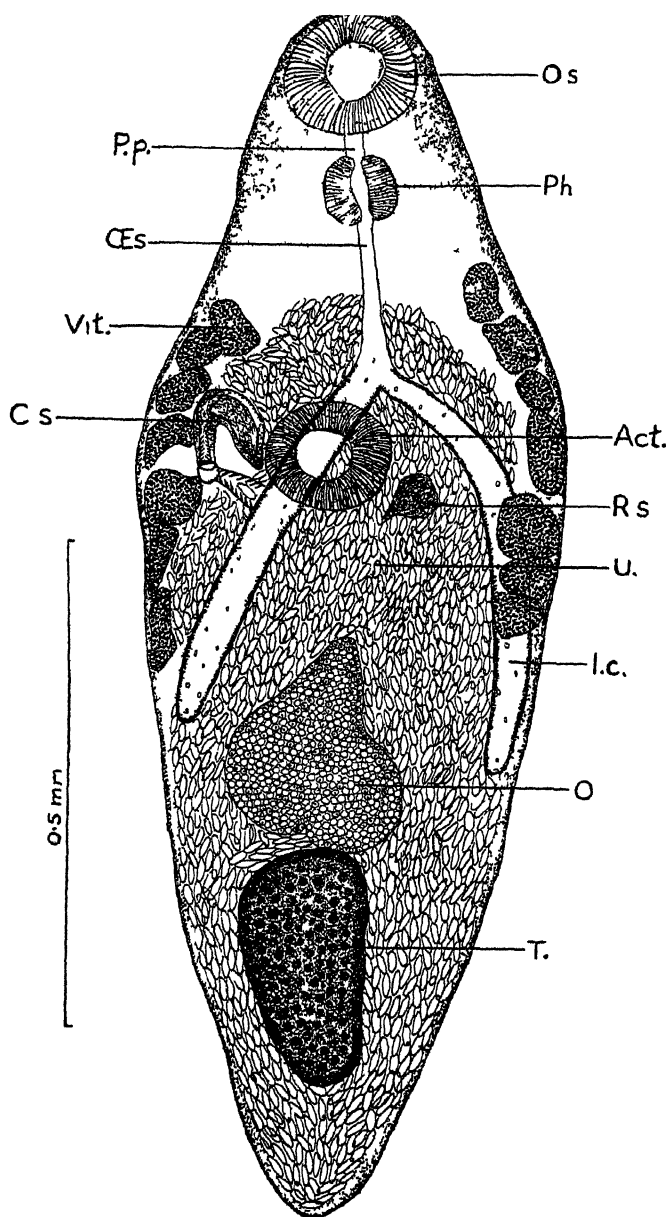
ASYMPHYLODORA LOOSS.

Looss created this genus in 1899 for *Dist. perlatum* Nordm., and also included in it *A. exspinoso* and *A. imitans*. In the 'Süsswasserfauna Deutschlands, 1909,' Lühe gave a diagnosis of the genus, besides a key and a short account of all the species known till then. He maintained four species as valid, i. e., *A. tinca* Modeer, 1790 (= *Dist. perlatum* Nordm.), *A. ferruginosa* Linstow, 1877 (= *Dist. punctum* Zeder, 1800), *A. exspinoso* Hausmann, 1896, and *A. imitans* Mühling, 1898. Issaitschikoff in 1923 added a new variety—*A. tinca* var. *kubanicum*—from Russian Cyprinoid fishes. In 1925 Ozaki described *A. macrostoma*, sp. n., from the cloaca of a Japanese fish—*Mogurnda obscura*. Yamaguti in 1934 reported *A. macrostoma* from a number of Japanese fishes and modified Ozaki's original account of the species. Witenberg and Eckmann in September 1934 published a critical review of the species of *Asymphylogora* in which they "came to the conclusion that there exists only one well-defined species of the genus *Asymphylogora*, namely, *A. tinca*, while other species are either synonyms of this species, or should be re-described to prove their validity." Whereas the validity of *A. ferruginosa*, *A. exspinoso*, and *A. imitans* will remain an open question till they are re-described, that of the Japanese species—*A. macrostoma*—cannot be doubted in view of the distinguishing features pointed out in this paper. In the following pages I give an account of a new species of the genus—the first representative of the family in an Indian fish.

Asymphylogora indica, sp. n.

About two dozen specimens were found parasitic in the gut of a pond-fish—*Ophiocephalus punctatus*—in January 1934. Out of over 500 specimens of the host examined

* This paper was read before the Academy of Sciences, U.P., India, on April 13, 1935.



Asymphytodora milica, sp. n.

Act, acetabulum, *Cs*, currus sac, *Ic*, intestinal caecum, *O*, ovary, *Os*, oral sucker, *Es*, oesophagus, *Ph*, pharynx. *P.p*, pre-pharynx, *Rs*, receptaculum seminis *T*, testis, *U* uterus, *Vit*, vitellaria

during the last three years, only one has so far been found infected. The worms have a fairly muscular and spindle-shaped body, measuring 0.86–1.4 mm. in length and 0.31–0.5 mm. in maximum breadth across the acetabular region. They are light brown in colour and show considerable power of contraction and expansion. The whole body is thickly beset with minute recurved spines which measure anteriorly 0.015×0.003 mm., but decrease both in number and size towards the hinder end. Unicellular glands with deeply-staining nuclei occur in large numbers in the pre-acetabular region, especially on the sides of the oesophagus.

The oral sucker is subterminal and spherical, measuring 0.12–0.14 mm. across. The acetabulum is spherical, rarely transversely oval, situated at the junction of the first and middle thirds of body, at times slightly shifted towards the left side. It is of nearly the same size as the oral sucker, measuring 0.12–0.13 mm. in diameter. The oral sucker is followed by a distinct prepharynx, 0.04–0.07 mm. long. The pharynx is well developed and muscular, measuring $0.06\text{--}0.08 \times 0.07\text{--}0.1$ mm. The oesophagus is a fairly long tube, 0.1–0.19 mm. in length, and bifurcates about the end of the first third of body into two cæca which extend as far as the middle of ovary. The excretory bladder is Y-shaped, with a rather narrow, slightly wavy main stem which bifurcates into two lateral cornua ventrally to the middle of the ovary and opens terminally at the hinder end.

The single testis is an elongated triangular or oval body measuring $0.14\text{--}0.26 \times 0.09\text{--}0.15$ mm., situated in the posterior third of the body, a little in front of the hinder end. It has usually a regular outline, but sometimes presents an irregularly lobed appearance. The cirrus-sac is a small, curved, inverted U-shaped structure, measuring $0.16\text{--}0.17 \times 0.04$ mm., to the left of the acetabulum, between the latter and the body-wall. It encloses a vesicula seminalis 0.06–0.1 mm. long, a pars prostatica 0.03–0.06 mm. in length, surrounded by prostate gland cells, and an armed protrusible cirrus. In some specimens the cirrus-sac lies between the genital atrium and the body-wall, but it never extends behind the acetabulum. The genital atrium, enclosing the male and female openings, lies usually halfway between the acetabulum

and left body-wall, ventral to the cæcum of the same side. Though always distinctly removed from the body-wall, it occupies varying positions between the latter and the acetabulum.

The ovary is roughly triangular or flask-shaped, sometimes lobed like the testis, $0.1-0.2 \times 0.1-0.2$ mm. in size, with a broad rounded base having a slight notch in the middle. It lies just in front of the testis, sometimes partly overlapping the latter. The shell-gland complex and yolk-reservoir lie in front of the ovary, between the latter and the acetabulum. A small, rather inconspicuous receptaculum seminis is situated on the right side, level with the middle or hinder part of the acetabulum, and opens into the oviduct through a very narrow canal. Laurer's canal is present. Often both the testis and the ovary are shifted slightly to the left side. The vitellaria are composed of a number of large irregular follicles arranged in a row, extending from behind the pharynx to the end of the cæca, usually outside but at times overlapping them. Sometimes the follicles are arranged in double rows at places on each side. The uterus is enormously developed, containing a great number of eggs and occupying all the free space from the middle of the oesophagus to the posterior end. Terminally it passes into a small, muscular, funnel-shaped, and armed metraterm, $0.04-0.06$ mm. long, which opens into the genital atrium close to the male opening. The eggs are oval and operculate, without any filament or spine, and measure $0.023-0.025 \times 0.01-0.013$ mm.

A. macrostoma Ozaki, 1925, emend. Yamaguti, 1934, differs from *A. tincæ* (Modeer, 1790), emend. Witenberg and Eckmann, 1934, in having the suckers of equal size (in *A. tincæ* the oral sucker is smaller than the acetabulum); in the larger size of the pharynx, which is more than half the size of the oral sucker (in the other species the pharynx is nearly half the size of the oral sucker); in the position of the vitellaria, which in the Japanese species extend from in front of the acetabulum to the posterior third of the body (in *A. tincæ* they never extend in front of acetabulum, reaching posteriorly the hinder end); in the smaller length of the cæca, which reach the posterior third of body, *i. e.*, in front

of the testis (in the other species they extend to the last quarter of the body); in the median position of the ovary, and in the absence of a filament or spine in the egg.

According to Witenberg and Eckmann, the shell-gland mass in *A. tinca* lies between the gonads, while in the Japanese species it lies in front of them. Its position between the gonads in this species needs confirmation, as Lühe in fig. 73 has shown it quite in front of the ovary. Even the joint authors in their fig. 2 have shown it in front of the ovary and partly overlapping the latter.

As regards its affinities, *A. indica*, sp. n., stands nearest to *A. macrostoma*, which it resembles in the equal size of the suckers, size of the pharynx, length of the cæca, position of the ovary and shell-gland mass, presence of a reduced receptaculum seminis, and absence of any filament or spine on the egg. It differs, however, from the Japanese species in its larger size, the greater length of the œsophagus, the anterior extent of the vitellaria, the shape, size, and position of the cirrus-sac, which never extends posterior to the acetabulum, the position of the genital atrium (about halfway between the acetabulum and body-wall), and the larger size of the eggs. The excretory bladder in the Indian species is Y-shaped, the main stem bifurcating at about the middle of the ovary into two lateral cornua. In the other two species the bifurcation into cornua has not been observed.

I am greatly indebted to Dr. H. R. Mehra for much valuable help and advice. Thanks are due to Dr. D. R. Bhattacharya for laboratory facilities in the Department. I am grateful to the Trustess of the Lady Tata Memorial Trust, Bombay, for the grant of a scholarship for investigations in Helminthology.

REFERENCES.

- HAUSMANN, L. 1897. "Ueber Trematoden der Süßwasserrische." *Revue Suisse de Zoologie*, Bd. 5, pp. 1-42, figs. 12.
 ISSAITSCHIKOFF, I. M. 1923. "On the Parasitic Worms of Cyprinoid Fishes of the Rivers of Kuban (in Russian)." *Les Œuvres de l'Inst. de l'Etat de la Méd. Vét. Expér.* vol. ii. 12 pp., figs. 5.
 LINSTOW, O. V. 1878. 'Compendium der Helminthologie.'
 LOOSS, A. 1894. "Die Distomen unserer Fische und Froesche." *Bibl. Zool. (Stuttgart)*, Heft 16, 296 pp., 9 pls. (192 figs.).

- LOOSS, W. 1899. "Weitere Beiträge zur Kenntniss der Trematoden-Fauna Ägyptens." Zool. Jahrb. Syst. vol. xii. 521-784, Taf. 24-32.
- LÜHE, M. 1909. "Trematodes." Brauer's 'Die Süsswasserfauna Deutschlands,' Heft 17.
- MÜHLING, P. 1898. "Die Holminthofauna der Wirbeltiere Ostpreussens." Archiv f. Naturg. i. Abt. Bd. 64, 118 pp., 4 pls., 28 figs.
- OZAKI, Y. 1925. "On a new Genus of Fish Trematodes, *Genarchopsis* and a new Species of *Asymphylogora*." Jap. Journ. of Zoology, vol. i. no. 3, pp. 101-108, 4 figs.
- WITENBERG, G., & ECKMANN, F. 1934. "Notes on *Asymphylogora tincae* (Trematoda)." Ann. & Mag. Nat. Hist. ser. 10, vol. xiv. pp. 366-371, figs. 2.
- YAMAGUTI, S. 1934. "Studies on the Helminth Fauna of Japan. Part 2. Trematodes of Fishes.—I." Jap. Journ. of Zoology, vol. v. no. 3, pp. 249-538, figs. 1-145.

XXX.—*A new Species of Amblypelta (Heteroptera, Coreidæ) from the British Solomon Islands.* By R. J. A. W. LEVER, B.Sc. Hon. (Dunelm), D.I.C. (Lond.), A.I.C.T.A. (Trinidad), F.L.S., F.R.E.S.

A DESCRIPTION of a new species of Coreid, *Amblypelta cocophaga* China, with notes on the range of the genus, was given in the 'Bulletin of Entomological Research,' vol. xxv. pt. 2, July 1934, by Mr. W. E. China. Another species has recently been taken on Isabel Island, in the British Solomon Islands, and is described below.

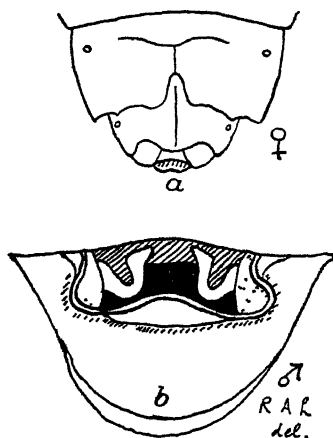
Amblypelta gallegonis, sp. n.

Colour.—Head bright orange, eyes dark brown, posteriorly orange, ocelli red; first segment of antennæ orange, second and third segments fuscous, fourth dark brown; rostrum flavous, distally fuscous, tip black; anterior third of pronotum orange, remainder dark metallic green and deeply punctate; anterior orange area continued as pleural stripe terminating in spine at posterior portion of pronotum. Scutellum blue-black, less deeply punctate, non-metallic. Hemelytra æneous, on costal and membranous margins veins fuscous; membrane smoky-hyaline. Hind wings hyaline, veins flavous. Legs orange, setose; claws black. Abdomen orange-red.

As this species so closely resembles *A. cocophaga* in structure, it is only necessary to list those characters in

which *A. gallegonis* differs from the first-named species. Dark streaks between ocelli absent; black marks at distal ends of first, second, and third antennal segments absent; pronotal spines smaller and blunter. Genitalia figured. Length 15 mm, breadth across pronotal spines 5 mm.

Isabel, British Solomon Islands Protectorate: Fula-kora (type ♀), 1. vii. 35, on *Codiazum variegatum*; Pele, 700 feet, 10. vii. 35, on *Manihot utilissima* (cassava).



Amblypelta gallegonis, sp. n.

a, ventral view of female genitalia; b, apical view of male pygophor showing parameres.

Types and co-types in the British Museum (Natural History).

This species is so similar to *A. cocophaga* China that it may have originated by isolation on Isabel Island, as it has not been taken elsewhere in the Solomons. Members of the natural order Euphorbiaceæ are evidently the usual food-plants.

The specific name commemorates the pioneer work of Hernando Gallego, the chief pilot of Mendaña's voyage of discovery to the Solomon Islands in 1567.

XXXI.—*A new Genus and Species of Capsidæ (Heteroptera) infesting Coffee in Kenya.* By W. E. CHINA, M.A., Department of Entomology, British Museum (Nat. Hist.).

THE following description is based on material submitted for determination by Mr. R. H. Le Pelley, Government Entomologist in Kenya Colony. This material also contained specimens of *Phytocoris alluaudi* Popp. from coffee plantations.

Family Capsidæ (*Miridæ*).

Subfamily CAPSINÆ.

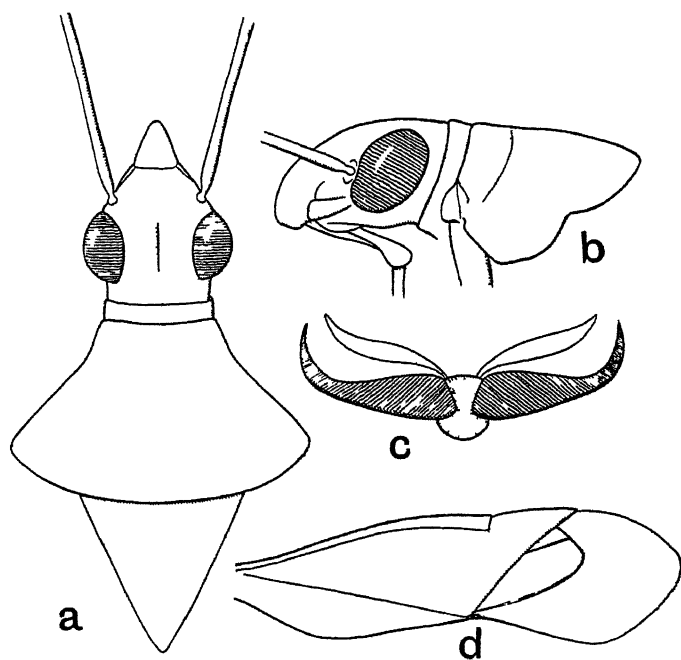
Tribe CAPSARIA Popp.

Genus KIAMBURA, nov.

Elongate, shining, above moderately densely pubescent. Head exserted, slightly deflexed, seen from above longer than wide across eyes, seen from side about twice as long as high at base; vertex feebly convex, without a basal carina, but with a shallow median longitudinal furrow. Clypeus prominent, feebly delimited from frons; loræ parallel-sided, rounded to clypeus; rostrum extending to apices of hind coxæ. Eyes large, elongate, not touching anterior margin of pronotum; anteriorly slightly emarginate behind antennæ, which are inserted close to upper half of anterior margin of eye. Antennæ very long and extremely slender, gradually tapering to a fine filamentous ending, feebly pubescent; first segment one and a half times as long as width of head including eyes. Pronotum about three-quarters as long as wide at base; basal margin broadly rounded, lateral margins distinctly emarginate anteriorly, not carinate; anterior collar long, flat, about one-eighth the total length of pronotum; calli obsolescent; disc feebly convex, rather indistinctly and shallowly punctate; scutellum four-fifths the length of pronotum, evenly convexly raised, very faintly rugose towards base. Hemelytra much longer than abdomen, not widening appreciably towards apex, very faintly rugosely punctate, costal margins slightly convex along apical two-thirds of corium; cuneus moderately long, membrane cells elongate, angularly rounded at apex, outer cell distinct. Hind wing cell without a hamus.

Metapleural orifice large and distinct. Legs long and slender, the hind femora extending slightly beyond apex of abdomen, their underside with a few long, very fine hairs; the hind tibiæ with a row of pale brown, moderately short bristles; relatively short hind tarsus with the two basal segments equally long and the apical segment slightly longer; claws large, strongly curved; arolia large, membranous, free, diverging from base.

Genotype: *Kiambura coffeæ*, sp. n.



Kiambura coffeæ, gen. et sp. n.

a, head and pronotum from above; b, same from side;
c, tarsal claws and arolia; d, hemielytron.

Apparently allied to *Horvathiella* Popp., but differs in the elongate head, broad (long) anterior pronotal collar, long thin antennæ and legs. The broad pronotal collar gives this genus the appearance of one of the *Macrolophinae*, but the structure of the arolia is typical of the *Capsaria*.

Kiambura coffeæ, sp. n.

Colour.—♀. Brownish yellow above; beneath pale yellow (green in life ?), with the lateral margin dark reddish brown.

Head fulvous, rather deeper towards apex, tinged with red on sides; gula pale yellow; rostrum pale yellow with apical segment black; antennæ pale yellow, with third and fourth segments infusate; eyes brown. Pronotum brownish yellowish, deepening to reddish brown anteriorly and laterally, the propleura and acetabulæ dark reddish brown, xyphus pale yellow; scutellum brownish yellow; hemielytra brownish yellow, deepening to reddish brown towards base of costa; apical margins of embolium and cuneus and membranal veins bright red; a triangular spot on membrane at apex of clavus black; membrane infumate. Meso- and metapleura, except ostiolar peritreme which is pale yellow, dark reddish brown; meso- and metasterna pale yellow. Coxæ, trochanters, femora, and base of tibiæ pale yellow, the apical three-quarters of tibiæ and tarsi pale green with bristles and claws pale brown. Venter pale yellow with lateral margins broadly dark reddish brown, this brown border narrowing to seventh ventrite and absent from eighth.

Male similar to female, but colour of upperside much darker brown, with apex of embolium and cuneus much more red; the penultimate abdominal sternites also more red.

Structure.—♀. Head including eyes about one-half the width of pronotum across humeral angles; vertex one-sixth broader than diameter of an eye; first antennal segment about one and a third times the length of head; relative length of segments 27 : 53 : 45 : 25. Basal margin of pronotum one and a half times wider than length of pronotum and two and a half times wider than anterior collar.

Male similar to female, but smaller and narrower with slightly shorter antennæ.

Total length, ♀ 6·5, ♂ 6·0 mm. Width across humeral angles, ♀ 1·7, ♂ 1·6 mm.

Hab. Kenya: Kiambu, 18 ♀♀, 5 ♂♂ (including type), and two larvæ "on coffee, C. 136" (R. H. Le Pelley), June 1931.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 99. MARCH 1936.

XXXII.—*On a Collection of Lymantriidæ (Heterocera) from North Yunnan.* By C. L. COLLENETTE, F.R.E.S.

[Plate VII.]

THROUGH the kindness of Mr. H. Höne, of Shanghai, and of Dr. Martin Hering, of the Zoologisches Museum der Universität, Berlin, I have received for determination a collection of Lymantriidæ made by Mr. Höne in the months of June to August 1934 in the neighbourhood of Li-kiang (26' 50° N., 100' 14° E.), North Yunnan.

Collecting was undertaken at three elevations—at about 8500 ft. (the altitude of Li-kiang), 10,000 ft., and 12,000 ft. (near the snow-line). No Lymantriidæ were obtained at the last-mentioned.

Of the 36 species of Lymantriidæ represented in the collection, 21 appear to be new to science—a strikingly large proportion. Mr. Höne is also to be congratulated on having obtained, in the majority of cases, a good series of each species with both sexes represented, which has much facilitated the work of classification.

The species throughout show a strong affinity with those from Northern India.

The collection and types have been returned to the Zoologisches Museum der Universität, Berlin, while paratypes and duplicate specimens have been kindly presented, where available, to the British Museum (Natural History).

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 22

Leucoma cygna Moore.

1 ♂, 8500 ft., 5th August, 1934.

Leucoma salicis candida Staudinger.

46 ♂♂, 3 ♀♀, 8500–10,000 ft., June to August 1934.

Arctornis ceconimena, sp. n. (Pl. VII. fig. 3.)

♂.—Palpus pale pinkish buff, tipped with orange-buff. Antennal shaft whitish; pectinations pale pinkish buff, dark at the base. Head pale pinkish buff, mixed with sepia. Thorax and abdomen, above and beneath, whitish, the patagium tinged with pale pinkish buff. Legs pale pinkish buff, lightly irrorated on the inside of the fore tibia with sepia. Wings semi-hyaline. Fore wing whitish, tinged, especially on the veins, with pale pinkish buff, and the whole wing irrorated lightly and evenly with fuscous; a small but conspicuous fuscous spot on the discocellulars just above the origin of vein *M*2; fringe whitish. Hind wing, the under side of both wings, and fringes whitish.

♀.—Resembles the ♂.

Expanse, ♂♂ 38–42 mm., ♀♀ 48–49 mm.

1 ♂ (holotype), 1 ♀ (allotype), 7 ♂♂ and 1 ♀ (paratypes), 10,000 ft., 5th to 9th August, 1934.

An interesting species, the position of the discocellular spot and the irroration on the fore wing being distinctive. Veins *R*1 and *R*2 in the fore wing rise from the cell. Veins *Rs* and *M*1 in the hind wing usually rise from a point, but in one specimen are slightly separated and in another are shortly stalked. Vein *M*3 rises rather farther from *Cu*1 than from *M*2.

Arctornis xanthochila, sp. n. (Pl. VII. fig. 2.)

♂.—Palpus white, at the tip and on the outer side capucine-yellow. Antennal shaft white, pectinations warm buff. Head white, the frons capucine-yellow. Thorax and abdomen, above and beneath, white. Legs whitish; tinged with capucine-yellow, especially on the inside of the tibia and tarsus of fore leg. Wings semi-hyaline, above and beneath whitish, with a dull surface; costa of fore wing narrowly edged with capucine-yellow; fringes whitish, mixed to a slight extent with capucine-yellow.

♀.—Resembles the ♂.

Expanse, ♂♂ 42–45 mm., ♀ 49 mm.

1 ♂ (holotype), 1 ♀ (allotype), and 5 ♂♂ (paratypes), 10,000 ft., 1st to 8th August, 1934.

Very similar in appearance to the next species, but can be distinguished by the dull surface of the wings, a slight admixture of capucine-yellow in the fringes, and the following details of venation :—veins *M*2 and *M*3 in the fore wing arise separately ; lower angle of cell in fore wing rounded ; veins *Rs* and *M*1 in hind wing from a point or shortly stalked.

Arctornis gelasphora, sp. n.

♂.—Palpus capucine-yellow. Antennal shaft white, pectinations warm buff. Head white, the upper part of the frons capucine-yellow. Thorax and abdomen, above and beneath, white. Legs whitish, tinged with capucine-yellow, especially on the fore and middle legs. Wings semi-hyaline ; white, including the fringes ; upper side of fore wing with a shiny surface ; costa of fore wing narrowly and indistinctly edged with capucine-yellow.

♀.—Resembles the ♂, but the capucine-yellow which edges the costa of the fore wing is less apparent, and absent in some specimens.

Expanse, ♂♂ 38–44 mm., ♀♀ 45–51 mm.

1 ♂ (holotype), 1 ♀ (allotype), 4 ♂♂ and 11 ♀♀ (paratypes), 8500–10,000 ft., June to August 1934.

May be distinguished from the last species by the shiny surface of the upper side of fore wing, the absence of capucine-yellow in the fringes, and the following details of venation : veins *M*2 and *M*3 in the fore wing arise from a point, (in two or three specimens they do not quite touch) ; lower angle of cell in fore wing pointed ; veins *Rs* and *M*1 in hind wing on a rather long stalk, varying in length in different specimens.

Arctornis cloanges, sp. n. (Pl. VII. fig. 4.)

♂.—Palpus fuscous, on the inner side white. Antennal shaft white, pectinations warm buff. Head, thorax, abdomen, and legs white. Wings semi-hyaline ; white, including the fringes ; the upper surface of the fore wing shining ; veins in both wings greenish.

Expanse, ♂♂, 44–48 mm.

1 ♂ (holotype) and 3 ♂♂ (paratypes), 8500–10,000 ft., 11th to 28th July, 1934.

The dark palpus, white legs, greenish veins, and two pairs of spurs on the hind tibia serve to distinguish this species.

AMPHEKES, gen. nov.

♂.—Proboscis short and aborted. Palpus slightly upturned, extending just beyond the frons, two-segmented, the second segment longer than the first. Eye round, in diameter about the width of frons. Antenna bipectinate, slightly more than one-third the length of costa, the branches at middle about one-fourth the length of shaft. Abdomen about three-fourths the length of inner margin of hind wing. Legs moderately haired. Process on fore tibia apparently double, the lower portion about three-fourths the length of tibia, broad and spatulate, the shorter portion lying along it, about three-fourths its length and bluntly pointed. Hind tibia with one pair of rather slender spurs of moderate length. Costa and inner margin of fore wing almost straight, apex and termen moderately rounded, tornus rather sharply angled; vein *Sc* parallel with the costa, veins *R*1 and *R*2 stalked, arising just before the upper angle of the cell, and separating at one-fourth the distance from cell to costa; *R*5 and *R*4 arising from *R*3 at one-third and two-thirds the distance from cell to apex; *M*1 from or just below upper angle; *M*2 from just above lower angle; *M*3 from lower angle; *Cu*1 from about four times the distance below *M*3 that *M*2 is above *M*3; *Cu*2 from one-half lower margin of cell; anal vein simple at base. Hind wing with costa and inner margin almost straight, apex, termen, and inner margin moderately rounded; vein *Sc* touching the cell for a short distance at about one-fifth; *Rs* and *M*1 from the upper angle or on a very short stalk; *M*2 from well above the lower angle; *M*3 from the lower angle; *Cu*1 from as far below *M*3 as *M*2 is above *M*3; *Cu*2 from just over one-half lower margin of cell; *A*2 and *A*3 straight; frenulum present.

♀.—Similar to the ♂, but with the pectinations of the antenna much shorter, and the process on the fore tibia thinner, single, and about two-thirds the length of tibia.

Type : *Amphokes gymna* Collenette.

Distinguished by the stalking of veins *R*₁ and *R*₂ in the fore wing and by the presence of only one pair of spurs on the hind tibia.

Amphokes gymna, sp. n. (Pl. VII. fig. 1.)

♂.—Palpus whitish, at the tip and on the outer side capucine-yellow. Antennal shaft white, pectinations cinnamon-buff. Head capucine-yellow mixed with xanthine-orange. Thorax and abdomen, above and beneath, white. Legs whitish, heavily mixed with capucine-yellow and xanthine-orange on fore and middle legs. Wings semi-hyaline, whitish above and beneath, the surface dull; a streak of opaque white scales on the costal half of the discocellulars in the hind wing; fringes white.

♀.—Resembles the ♂.

Expanse, ♂ 42 mm., ♀♀ 48–51 mm.

1 ♂ (holotype), 1 ♀ (allotype), and 3 ♀♀ (paratypes), 10,000 ft., 27th July to 5th August, 1934.

Caragolina costalis Moore.

2 ♂♂, 8500–10,000 ft., 13th July and 3rd August, 1934.

This species, which is rare in collections, does not appear to have been recorded previously from China.

Euproctis glaphyra, sp. n. (Pl. VII. fig. 6.)

♂.—Palpus light orange-yellow, on the outer side fuscous. Antennal shaft pale orange-yellow, pectinations clay-colour. Head and thorax Mars-yellow, the vertex lighter. Abdomen above and beneath fuscous-black, at the base light orange-yellow; anal tuft Mars-yellow. Pectus and legs light orange-yellow mixed with light buff. Fore wing and fringe light orange-yellow. Hind wing and fringe pale orange-yellow. Under side of fore wing and fringe light orange-yellow, the whole of the wing, excepting at the margins, shaded to a varying extent in different specimens with fuscous. Under side of hind wing and fringe pale orange-yellow.

♀.—Resembles the ♂, but the fuscous shading on the under side of fore wing almost absent.

Expanse, ♂♂ 36–40 mm., ♀♀ 40–46 mm.

1 ♂ (holotype), 1 ♀ (allotype), 38 ♂♂ and 1 ♀ (paratypes), 8500–10,000 ft., July and August 1934.

In five or six of the ♂♂ there is a faint trace of a medial fascia on the fore wing, indicated by a few darker scales near the inner margin.

Somewhat resembles *Euproctis montis* Leech, which has a whitish hind wing, and a narrower fore wing in comparison with its length.

Euproctis schaliphora, sp. n. (Pl. VII. fig. 10.)

♂.—Palpus maize-yellow, sparsely marked with fuscous on the outer side. Antennal shaft maize-yellow, pectinations clay-colour. Head and thorax orange-buff, the vertex lighter. Abdomen fuscous-black, at the base maize-yellow; anal tuft Mars-yellow. Pectus, venter, and legs light buff, the fore leg tinged with maize-yellow. Fore wing and fringe maize-yellow. Hind wing above and beneath, under side of hind wing and fringes, pale pinkish buff; on the under side of fore wing in a few specimens some faint tawny-olive shading in and beyond the cell and along the costa, but not reaching the apex.

♀.—Resembling the ♂, but considerably lighter in colour, and without the tawny-olive shading on the under side of fore wing.

Expanse, ♂♂ 30–36 mm., ♀♀ 39–44 mm.

1 ♂ (holotype), 1 ♀ (allotype), 16 ♂♂ and 8 ♀♀ (paratypes), 8500–10,000 ft., May to August 1934.

In two or three ♂♂ there is a faint trace of a medial fascia on the fore wing. Easily distinguished from the preceding species and from *Euproctis montis* Leech by the fact that veins *M*3 and *Cu*1 in the hind wing are stalked.

Euproctis, sp. n.

1 ♂, 10,000 ft., 1st July, 1934.

This insect represents an undescribed species, but is not in good enough condition for naming. It resembles the two preceding species, with veins *M*3 and *Cu*1 in the hind wing separated.

Euproctis straminea Leech (?).

2 ♂♂, 1 ♀, 8500 ft., 18th July to 9th August, 1934.

These three specimens, all of which are somewhat rubbed, agree very closely with examples of this species from country to the north and east of Yunnan. However, they show no trace of the medial fascia on the fore wing.

In the absence of further material I do not think it advisable to deal with them further.

Euproctis nigrifulva Gaede.

8 ♂♂, 8500–10,000 ft., May to August 1934.

Euproctis electrophæa, sp. n. (Pl. VII. fig. 7.)

♂.—Palpus, head, and thorax light orange-yellow. Antennal shaft orange-yellow, pectinations light ochraceous-buff. Abdomen pinkish buff, each segment broadly edged distally with fuscous-black; anal tuft Mars-yellow. Pectus pinkish buff. Venter fuscous-black. Legs pale pinkish buff fringed with long amber-yellow hair-scales. Fore wing amber-yellow, crossed by three broad fasciæ composed of fuscous irroration, directed similarly to those in *Euproctis inconcisa* Walker; three conspicuous inter-neural fuscous-black spots, between veins *R*4 and *R*5, *M*1 and *M*2, and *Cu*2 and the anal vein; fringe amber-yellow. Hind wing and fringe pale pinkish buff. Under side of fore wing pale pinkish buff; a broad streak of tawny olive along the costa, not reaching the apex, and in some specimens obsolescent; fringe amber-yellow. Under side of hind wing and fringe pale pinkish buff.

♀.—Resembles the ♂, but rather paler in coloration.

Expanse, ♂♂ 38–40 mm., ♀♀ 45 mm.

1 ♂ (holotype), 1 ♀ (allotype), 3 ♂♂ and 1 ♀ (paratypes), 8500–10,000 ft., 9th to 24th July, 1934.

Similar to *Euproctis inconcisa* Walker, but with rather broader fasciæ, and three conspicuous fuscous-black subterminal spots on the fore wing.

Euproctis brachyclæna, sp. n. (Pl. VII. fig. 13.)

♂.—Palpus warm buff, above and on the outer side sepia. Antennal shaft warm buff, pectinations clay-colour. Head and thorax warm buff to ochraceous-buff. Abdomen fuscous-black, antimony-yellow at the base, anal tuft antimony-yellow. Pectus and venter light buff, mixed on the venter with fuscous-black. Legs warm buff. Basal two-thirds of fore wing buckthorn-brown, irrorated sparsely with sepia; a narrow streak of buff-yellow along the costa; a buff-yellow antemedial fascia running across the cell to the origin of vein *Cu*2, thence to the inner margin, which it meets at right-angles;

distal third of wing buff-yellow, the line of junction with the buckthorn-brown area being approximately straight, excepting between veins *M*3 and *Cu*1, where the buckthorn-brown slightly invades the buff-yellow, and beyond which is a faint interneural buckthorn-brown spot; fringe buff-yellow. Hind wing and fringe light buff. Under side of fore wing warm buff, grading to light buff along the inner margin; a patch of Saccardo's-umber, roughly corresponding to the buckthorn-brown area on the upper surface, but not reaching the inner margin; fringe warm buff. Under side of hind wing and fringe light buff.

Expanse, ♂♂, 33–34 mm.

1 ♂ (holotype) and 2 ♂♂ (paratypes), 8500–10,000 ft., June to August 1934.

Related to *Euproctis anguligera* Butler.

Euproctis varia Walker.

1 ♂, 10,000 ft., 7th August, 1934.

Euproctis conistica, sp. n. (Pl. VII. fig. 5.)

♂.—Palpus orange-buff, on the outer side fuscous-black. Antennal shaft pale orange-yellow, pectinations buckthorn-brown. Head and patagium orange-buff, remainder of thorax pale orange-yellow. Abdomen fuscous-black, at the base pale orange-yellow, anal tuft orange-buff. Pectus, venter, and legs pale orange-yellow, mixed on the fore leg with orange-buff; a streak of fuscous-black on the inside of the fore tibia. Fore wing maize-yellow, irrorated throughout the cell, and interneurally for a short distance outside the cell from vein *R*5 to the anal vein, with fuscous-black; fringe maize-yellow. Hind wing and fringe pale pinkish buff. Under side of fore wing maize-yellow, grading to pale pinkish buff in the inner marginal area; a broad streak of fuscous running from the base, along the upper margin of the cell, and finishing about four millimetres before the termen; fringe maize-yellow. Under side of hind wing, and fringe, pale pinkish buff.

♀.—Resembles the ♂, but with a paler thorax, legs whitish and without the streak of fuscous-black on the fore tibia, wings whitish throughout, the fuscous-black irroration present on the upper side of fore wing, but the

fuscous streak on the under side of fore wing much reduced.

Expanse, ♂♂ 36–44 mm., ♀♀ 41–48 mm.

1 ♂ (holotype), 1 ♀ (allotype), 202 ♂♂ and 72 ♀♀ (paratypes), 8500–10,000 ft., May to August 1934.

A very fine and distinct species, showing marked sexual dimorphism. A very small proportion of specimens of both sexes show a fuscous-black subterminal spot on the fore wing between veins *M*1 and *M*2, and still more rarely a second spot above the first between veins *R*5 and *M*1.

Euproctis callichlæna, sp. n. (Pl. VII. fig. 14.)

♂.—Palpus ochraceous-buff, mixed on the outer side with Prout's-brown. Antennal shaft tawny-olive, pectinations cinnamon-buff. Head and patagium ochraceous-buff, remainder of thorax, pectus, and abdomen above and beneath, warm buff to light buff. Fore leg ochraceous-buff, the femur and tibia fringed with long hair-scales; middle and hind legs lighter in colour. Fore wing sepia mixed with Prout's-brown, the veins light buff, giving the effect of a network over the wing; a broad band of light buff along the costa almost to the apex; an antemedial fascia of light buff across the middle of the cell to the origin of vein *Cu*2, and from behind the origin of *Cu*2 oblique inwardly to the inner margin; the sepia and Prout's-brown area is edged distally with a subterminal fascia of light buff, beyond which to the termen stretches a band of bright ochraceous-tawny, with three conspicuous sepia spots, between veins *R*5 and *M*1, *M*3 and *Cu*1, and on each side of the anal vein; a fourth and smaller spot occurs in some specimens between veins *R*4 and *R*5; fringe ochraceous-buff. Hind wing light buff, slightly darker at the termen, and with a faint darker shade over the basal half of the wing; fringe pinkish buff. Under side of fore wing Saccardo's-umber; costal and terminal areas, and fringe, ochraceous-buff. Under side of hind wing, and fringe, light buff.

Expanse, ♂♂, 34–37 mm.

1 ♂ (holotype) and 16 ♂♂ (paratypes), 10,000 ft., July to August 1934.

A striking species, with wing-pattern very dissimilar to any other in the genus.

Medama diplaga Hampson.

6 ♂♂, 10,000 ft., August 1934.

Dasychira simiolus, sp. n. (Pl. VII. fig. 11.)

♂.—Palpus Saccardo's-umber, bushy. Antennal shaft sepia, pectinations fuscous. Head, thorax, and abdomen sepia, mixed sparsely with pale pinkish buff. Pectus, venter, and legs drab, mixed on the legs with Saccardo's-umber. Fore wing sepia; some indistinct fuscous markings basally; a fuscous antemedial fascia, almost straight, oblique inwardly from costa to inner margin; reniform edged with fuscous; a well-defined crenate fuscous postmedial fascia, commencing above the reniform, curving closely round its distal side, thence descending oblique inwardly to the inner margin; some indistinct fuscous subterminal markings; a series of fuscous interneural preterminal spots; fringe sepia, lighter at the vein-ends. Hind wing and fringe Saccardo's-umber, with a faint darker shade on the discocellulars. Under side of fore wing Saccardo's-umber; fringe of the same colour, lighter at the vein-ends. Under side of hind wing drab; a faint Saccardo's-umber shade on the discocellulars, and broad but indistinct postmedial and subterminal fasciæ of the same colour, running roughly parallel with each other from costa to inner margin; fringe Saccardo's-umber.

♀.—A somewhat lighter insect than the ♂. In the fore wing a conspicuous oblique pinkish-buff streak surrounding the reniform, and a broad streak of the same colour running through the subterminal and inner marginal areas.

Expanse, ♂♂ 37–38 mm., ♀♀ 41–44 mm.

1 ♂ (holotype), 1 ♀ (allotype), 1 ♂ and 4 ♀♀ (paratypes), 8500–10,000 ft., June to August 1934.

May be placed near to *Dasychira dalbergiæ* Moore. The postmedial fascia in the ♂ gives the fanciful outline of an ape's head seen in profile, which has suggested the name of the species.

Dasychira polysphena, sp. n. (Pl. VII. fig. 17.)

♀.—Palpus sepia mixed with snuff-brown. Antennal shaft whitish ringed with sepia; pectinations sepia. Head and thorax snuff-brown mixed with whitish. Abdomen above and beneath, pectus and legs snuff-

brown, mixed on the legs with sepia. Fore wing with basal and medial area mainly dark purplish grey; a large rounded patch of snuff-brown between the base of the wing and the antemedial fascia; an antemedial and a postmedial fascia of fuscous-black, indistinct towards the costa, the antemedial wavy, the postmedial bowed (convexity basad) from the lower angle of cell to inner margin; a broad stripe of snuff-brown, mixed with whitish, running oblique outwardly from the origin of vein *Cu*₂, enclosing the reniform, to the costa; a broad stripe of dark purplish grey and fuscous-black running from the lower angle of the cell to the apex; the area between the postmedial fascia and the termen mainly snuff-brown; an irregular whitish subterminal fascia; a series of fuscous-black wedge-shaped stripes on the veins, their points touching a preterminal fuscous-black line; fringe fuscous, whitish at the vein-ends. Hind wing snuff-brown; a faintly visible dark postmedial fascia, almost straight; fringe Saccardo's-umber, tipped with whitish. Under side of fore wing snuff-brown, darker towards the base, and with a dark streak running from the lower angle of the cell to the apex; fringe as on upper side. Under side of hind wing snuff-brown; a dark spot on the discocellulars and traces of a postmedial fascia; fringe as on upper side.

Expanse, ♀♀, 39 mm.

1 ♀ (holotype) and 1 ♀ (paratype), 8500–10,000 ft., 8th & 14th July, 1934.

May be placed near to the preceding species.

Dasychira pennatula Fabricius.

1 ♂, 10,000 ft., 3rd June, 1934.

Dasychira flavimacula Moore.

2 ♂♂, 10,000 ft., 11th July, 1934.

Dasychira varia Walker.

1 ♀, 8500 ft., 6th June, 1934, and 1 ♀, 10,000 ft., 1st June, 1934.

Dasychira feminula likiangensis, subsp. n.

(Pl. VII. fig. 19.)

♂.—Agrees with *Dasychira feminula* Hampson (Nilgiris), excepting that in the fore wing the reniform spot is

slightly larger, the postmedial fascia not crenate, and the series of spots in the subterminal area, which are wedge-shaped in *D. feminula*, indistinct and more rounded.

Expanse, ♂♂, 41–47 mm., averaging about 45 mm.

1 ♂ (holotype) and 75 ♂♂ (paratypes), 8500–10,000 ft., May to July 1934.

Can be quickly distinguished from the Nilgiri race by the shape of the postmedial fascia. Variation in markings throughout the series of 76 ♂♂ is comparatively small.

Dasychira semicirculosa Gaede (?).

2 ♂♂, 1 ♀, 10,000 ft., May to July 1934.

These specimens, which are in rather poor condition, may be placed provisionally to this species, which is known from a single ♂ taken at Ta-t sien-lou in Sze-chwan. The ♀ resembles the ♂ in shape and venation, but the markings are largely obscured; the ground-colour of the fore wing is snuff-brown.

Dasychira hoenei, sp. n. (Pl. VII. fig. 15.)

♂.—Palpus tawny-olive, on the outer side fuscous. Antennal shaft fuscous, pectinations amber-brown. Frons pinkish buff, shading on the vertex to bistre. Thorax amber-brown banded with bistre, the latter colour predominating in some insects of the series and in others being almost or entirely absent. Abdomen Mars-yellow, with a broad sepia dorsal line from base to anal tuft, which is tipped with pinkish buff. Pectus and venter pinkish buff, the latter edged laterally with a line of sepia. Legs pinkish buff, banded on tibiae and tarsi with sepia. Fore wing amber-brown; a subbasal and an antemedial fascia, bistre, crenate, and roughly parallel, the space between them filled in with bistre and bordered narrowly on each side with pale pinkish buff; a large reniform spot edged with streaks and spots of bistre; a crenate bistre postmedial fascia, bordered on each side, from costa to vein *R*5 or *M*1, with pinkish buff, bowed (concavity basad) from costa to vein *Cu*2, thence to inner margin, which it meets at right angles; a pinkish-buff subterminal fascia, roughly parallel with the postmedial fascia, the space between the two fasciæ filled in with bistre; some bistre shading beyond the subterminal, followed by a bistre preterminal fascia, broken

at the veins; fringe amber-brown, fuscous interneurally. Hind wing sepia, the basal half of the wing somewhat lighter and showing a sepia shade on the discocellulars; fringe sayal-brown, the same colour continuing in some specimens along the inner marginal area. Under side of both wings sayal-brown; a patch of sepia on each of the discocellulars; on the fore wing a sepia postmedial fascia, broken at the veins, and varying considerably in extent in different specimens; on the hind wing, the area between the postmedial and the termen mainly filled in with sepia, the extent of which also varies considerably in different specimens; fringes sayal-brown, in the fore wing marked interneurally with sepia.

♀.—Resembles the ♂, but lighter in colour throughout.

Expanse, ♂♂ 49–57 mm., ♀ 65 mm.

1 ♂ (holotype), 1 ♀ (allotype), and 13 ♂♂ (paratypes), 8500–10,000 ft., June and July 1934.

A very handsome new species, related to *Dasychira complicata* Walker, but abundantly distinct therefrom.

Dasychira strigata Moore.

9 ♂♂, 1 ♀, 8500–10,000 ft., July and August 1934.

Rather larger and brighter than specimens from Northern India, but not otherwise distinguishable.

Dasychira psolobalia, sp. n. (Pl. VII. fig. 9.)

♂.—Palpus Mars-yellow, on the upper side fuscous. Antennal shaft white irrorated with fuscous, pectinations snuff-brown. Head light buff, mixed on the frons with fuscous. Patagium light buff, remainder of thorax fuscous, mixed with a few hair-scales of light buff. Abdomen mummy-brown mixed sparsely with orange-buff; anal tuft orange-buff. Pectus, venter, and legs pinkish buff mixed with fuscous, tarsi and tibiæ irrorated with snuff-brown. Fore wing with ground-colour light buff, irrorated sparsely over the whole area with capucine-yellow and heavily marked with sepia; the pale ground-colour is apparent principally in the cell, in an antemedial fascia running oblique inwardly from cell to inner margin, in a streak on the discocellulars, in a broad postmedial fascia, oblique outwardly from costa to vein *M*₁, thence oblique inwardly and almost straight to the inner margin, and in a broad patch in the terminal area, where it is

widest in the centre, narrowing towards apex and tornus ; ringe light buff, sepia interneurally. Hind wing and, fringe mummy-brown, the latter mixed with light buff. Under side of fore wing mummy-brown ; a conspicuous streak of pale orange-yellow along the costa from the postmedial to the subterminal area ; in the terminal area an admixture of light buff, giving an irrorated effect ; fringe light buff, mummy-brown interneurally. Under side of hind wing light buff irrorated heavily with mummy-brown ; fringe light buff mixed with mummy-brown.

♀.—Similar to the ♂, but lighter, especially in the hind wing. The yellow streak on the under side of the fore wing and the yellow on the palpus, which are conspicuous in the ♂, and scarcely indicated in the majority of the ♀♀.

Expanse, ♂♂ 44–48 mm., ♀♀ 52–61 mm.

1 ♂ (holotype), 1 ♀ (allotype), 4 ♂♂ and 7 ♀♀ (paratypes), 8500–10,000 ft., June to August 1934.

A very interesting and distinct new species. The unusual arrangement of the small streaks in the distal part of the fore wing, more especially in the ♀, recalls a somewhat similar appearance in the case of *Pida strigipennis* Moore.

Dasychira pilodes, sp. n. (Pl. V.I. fig. 12.)

♂.—Palpus Mars-yellow, on the outer side fuscous. Antennal shaft whitish, irrorated sparsely in the distal half with fuscous ; pectinations Brussels-brown. Head and thorax cinnamon-buff to clay-colour. Abdomen Mars-yellow, lighter at the base of each segment, anal tuft cinnamon-buff. Pectus, venter, and legs cinnamon-buff, mixed on the legs with fuscous and on the tibiæ with Mars-yellow. Fore wing tawny-olive, grading towards the termen and inner margin to sayal-brown ; a subbasal fuscous fascia, not reaching the inner margin ; a fuscous antemedial fascia, about one millimetre broad, running oblique outwardly from the costa at one-quarter to the lower margin of the cell, thence to the inner margin, which it meets at right-angles ; a fuscous spot on the discocellulars ; a fuscous postmedial fascia, about as broad as the antemedial, bowed (concavity basad) from costa to the origin of vein *Cu*₁, thence parallel with the antemedial to the inner margin ; some slight fuscous

irroration in the distal third of the wing; fringe fuscous, tipped with pinkish buff, and lighter at the vein-ends. Hind wing cinnamon-buff irrorated lightly with fuscous; a fuscous spot on the discocellulars; fringe as on fore wing. Under side of both wings cinnamon-buff irrorated lightly with fuscous; a broad streak of orange-buff along the costa of the fore wing, not reaching the apex; a fuscous spot on the discocellulars of both wings; fringes fuscous, lighter at the vein-ends.

♀.—Resembles the ♂, but lighter in colour, and with no dark colouring on the wing-fringes.

Expanse, ♂♂ 41–45 mm., ♀♀ 46–54 mm.

1 ♂ (holotype), 1 ♀ (allotype), 8 ♂♂ and 12 ♀♀ (paratypes), 8500–10,000 ft., May to August 1934.

A very distinct species, which I have placed provisionally in the genus *Dasychira*.

Dasychira planozona, sp. n. (Pl. VII. fig. 18.)

♂.—Palpus Saccardo's-umber. Antenna sepia. Head and thorax tawny-olive mixed with sepia. Abdomen ochraceous-buff mixed with sepia, the segments edged posteriorly with sepia. Pectus and venter pale pinkish buff mixed with tawny-olive. Legs pale pinkish buff, mixed and banded with snuff-brown and sepia. Fore wing sayal-brown, mixed over the greater part of the surface with drab-grey; a well-defined fuscous antemedial fascia, edged proximally with sayal-brown, sharply indented in the cell and between *Cu*2 and the anal vein; reniform sayal-brown bordered with fuscous; some whitish markings along the costa, especially above the reniform; an irregular fuscous postmedial fascia, commencing above the reniform, curving rather closely round it to vein *Cu*2, thence oblique outwardly to the inner margin; an irregular subterminal fascia, sayal-brown mixed with fuscous and whitish; a preterminal fuscous line, broken at the veins and bordered towards the costa with whitish; fringe drab mixed with fuscous. Hind wing and fringe drab, and a darker spot on the discocellulars. Under side of fore wing sepia; a streak of tawny-olive mixed with sepia along the costa; a faint fuscous postmedial fascia, well defined where it crosses the lighter streak along the costa; fringe sepia, whitish at the vein-ends. Under side of hind wing drab; a sepia spot on the discocellulars;

a well-defined almost straight fuscous postmedial fascia ; an indistinct fuscous subterminal fascia, not reaching the anal angle ; fringe drab.

♀.—Resembles the ♂.

Expanse, ♂♂ 38–41 mm., ♀♀ 38–42 mm.

1 ♂ (holotype), 1 ♂ (allotype), 8 ♂♂ and 6 ♀♀ (paratypes), 8500–10,000 ft., June and July 1934.

Cifuna locuples Walker.

6 ♂♂, 1 ♀, 8500 ft., July to August 1934.

The ♂♂ are larger and rather lighter than North Indian specimens.

Lymantria mathura Moore.

1 ♂, 10,000 ft., 4th August, 1934.

Lymantria serva Fabricius.

13 ♂♂, 3 ♀♀, 8500–10,000 ft., June to August 1934.

Expanse, ♂♂ 41–44 mm., ♀♀ 48–54 mm.

Both sexes show considerable variation, the hind wing in some specimens being snuff-brown or Saccardo's-umber, without markings, and in others pinkish buff with a darker subterminal fascia.

Lymantria servula, sp. n. (Pl. VII. fig. 8.)

♂.—Palpus drab, on the outer side fuscous, and tinged with strawberry-pink at the base. Antenna tawny-olive, bases of pectinations fuscous, shaft banded with the same colour. Head and thorax fuscous mixed with tawny-olive and pale pinkish buff, and a small patch of strawberry-pink at the base of the antenna. Abdomen, pectus, and venter tawny-olive. Leg ; tawny-olive, the tibiae and tarsi mixed and banded with fuscous. Fore wing with ground-colour whitish, heavily marked with fuscous and snuff-brown, the pattern bearing considerable resemblance to that of *Lymantria serva* Fabricius, excepting that the portion of the postmedial fascia which runs from vein *Cu*2 to the inner margin is directed at right angles to the costa, and not almost parallel with the termen as in *L. serva* ; fringe whitish, fuscous interneurally. Hind wing pinkish buff, with a faintly marked dark shade on the costal half of the discocellulars and along the whole of the terminal area ; fringe pinkish buff.

Under side of fore wing drab, with faint lighter markings; fringe whitish, with fuscous markings interneurally, which are continued along the costa. Under side of hind wing, and fringe, pinkish buff.

♀.—Resembles the ♂, but with markings on the fore wing much less distinct. Abdomen coral-pink above.

Expanse, ♂♂ 35–39 mm., ♀ 41 mm.

1 ♂ (holotype), 1 ♀ (allotype), and 9 ♂♂ (paratypes), 8500–10,000 ft., June to August 1934.

Allied to *Lymantria serva* Fabricius (which occurs in the same area), but smaller, and with differently placed markings towards the tornus, as indicated in the description above.

Lymantria argyrochroa, sp. n. (Pl. VII. fig. 16.)

♂.—Palpus drab, mixed on the outer side with sepia. Antennal shaft snuff-brown; pectinations tawny-olive, darker towards the base. Head and thorax fuscous mixed with pale pinkish buff, and with traces of a collar of peach-red between head and thorax. Abdomen drab mixed sparsely with strawberry-pink, anal tuft darker. Pectus and venter drab mixed with sepia. Legs drab, mixed and banded with sepia. Fore wing drab, marked with snuff-brown, sepia, and pale drab-grey, the last-mentioned giving a distinctive silvery “bloom” to the wing; markings very similar to those of *L. dissoluta* Swinhoe; fringe drab mixed with pale drab-grey, and marked with sepia interneurally. Hind wing drab mixed with pale pinkish buff; a line of snuff-brown along the termen; fringe drab, marked with snuff-brown interneurally. Under side of both wings Saccardo’s-umber mixed sparsely with pale drab-grey, and with traces of the upper side pattern faintly indicated; fringe drab mixed with pale drab-grey, marked interneurally with Saccardo’s-umber.

Expanse, ♂♂, 49–52 mm.

1 ♂ (holotype) and 5 ♂♂ (paratypes), 10,000 ft., July and August 1934.

Strongly resembling in markings *Lymantria dissoluta* Swinhoe (Hongkong), but considerably larger and darker, and with a noticeable silvery “bloom” on the fore wing. The genitalia show marked differences in uncus and valves.

There are two unnamed ♂♂ in the British Museum Collection with imperfect data, but known to have come from Burma or Northern India, which are probably not separable from the above Li-kiang specimens.

EXPLANATION OF PLATE VII.

(Figures are slightly less than life-size.)

- Fig. 1. *Amphelkes gymna*, gen. et sp. n., type ♂.
 Fig. 2. *Arctornis xanthochila*, sp. n., type ♂.
 Fig. 3. — *ceconimena*, sp. n., type ♂.
 Fig. 4. — *cloanges*, sp. n., type ♂.
 Fig. 5. *Euproctis consistica*, sp. n., type ♂.
 Fig. 6. — *glaphyra*, sp. n., type ♂.
 Fig. 7. — *electrophaes*, sp. n., type ♂.
 Fig. 8. *Lymantria servula*, sp. n., type ♂.
 Fig. 9. *Dasychira psolobalia*, sp. n., type ♂.
 Fig. 10. *Euproctis schaliphora*, sp. n., type ♂.
 Fig. 11. *Dasychira simiolus*, sp. n., type ♂.
 Fig. 12. — *pilodes*, sp. n., type ♂.
 Fig. 13. *Euproctis brachychlæna*, sp. n., type ♂.
 Fig. 14. — *callichlæna*, sp. n., type ♂.
 Fig. 15. *Dasychira hoenei*, sp. n., type ♂.
 Fig. 16. *Lymantria argyrochroa*, sp. n., type ♂.
 Fig. 17. *Dasychira polysphæna*, sp. n., type ♀.
 Fig. 18. — *planozona*, sp. n., type ♂.
 Fig. 19. — *feminula likiangensis*, subsp. n., type ♂.

XXXIII.—*Descriptions and Records of Bees.*—CLIII.

By T. D. A. COCKERELL, University of Colorado.

THE types of all the new bees described herein will be placed in the British Museum.

Afrostelis ogilviei, sp. n.

♀.—Length about 5.4 mm., anterior wing about 4.7.

Black, including antennæ, tegulæ, and legs; eyes dark reddish; mandibles broad, tridentate, obscurely reddish apically; face with thin white hair, most conspicuous at sides; clypeus very finely and closely punctured, the lower margin straight; front, vertex, and mesothorax with similar punctures, appearing very coarse under microscope; no smooth space on vertex; scutellum large, with very large punctures, fully twice the size of those on hind part of mesothorax, and showing a small central disc; posterior truncation of thorax vertical, at right angles to the dorsum, which is long and straight in profile; sides of thorax with thin white hair, and hind

margin of scutellum with a thin fringe of white hairs ; scape very finely punctured, not hairy ; tegulæ very large, punctured, shining, with hairy margins. Wings dilute fuliginous ; stigma small and black ; basal nervure going a trifle basad of nervulus, which is not oblique ; second cubital cell long, receiving first recurrent nervure far from base (distance rather more than equal to half intercubitus), and second recurrent going beyond its apex. Legs with thin white hair. Abdomen robust, well punctured ; greyish-white hair-bands at sides of first three tergites, an entire but very weak one on fourth, fifth, and sixth with thin pile ; sternites with hair-bands. With a side light the mesothorax shows a broad median sulcus.

S. Rhodesia : Matopo Hills, April 17-30, 1932 (*J. Ogilvie*).

Related to *A. tegularis* Ckll., from the Ruzizi Valley, but known by the dark wings. It is possibly, but not probably, the female of *A. æthiopica* (Friese), from Willowmore.

A second specimen, slightly over 6 mm. long, is from Afdeling Farm, Bosrand, Orange Free State, March 29, 1934 (*J. Ogilvie*).

Afrostelis tegularis Cockerell.

Natal : National Park, March 3-15, 1932 (*J. Ogilvie*).

It differs (female) from *A. ogilviei* Ckll. by the conspicuous shining spot laterad of each lateral ocellus, and the wings, which are hyaline, with a strong dusky apical cloud. It thus appears to be the female of *A. tegularis*, which was described (1931) from the male.

A male *A. tegularis* is from Uvira, Belgian Congo, Aug. 28-29 (*J. Ogilvie*).

Heriades binodosus, sp. n.

♀.—Length about 8 mm., anterior wing 4.8.

Black, with scanty white hair, faintly flavescent on head and thorax above, ventral scopa pale orange-ferruginous, white at extreme sides ; mandibles, antennæ, and tegulæ black ; mandibles very large, the long very oblique cutting-edge with four teeth ; clypeus convex, polished, with sparse strong punctures, the lower edge with two large tubercles ; sides of face with long dull white hair ; front strongly punctured and with a median

sulcus; cheeks convex and very broad; mesothorax and scutellum very coarsely punctured, shining between the punctures, which are well separated on disc of mesothorax; axillæ not spined; a shining band at base of metathorax. Wings dusky, violaceous, the outer margin green, edged on inner side with pink; stigma moderately large; basal nervure curved, falling a little short of nervulus; second cubital cell long, receiving first recurrent nervure far from base, the second near apex. Abdomen strongly punctured, the tergites with more or less imperfect white hair-bands, the apical tergite hardly at all pruinose-pubescent.

Cape Province: Ceres, Mitchell's Pass, Feb. 9-17, 1932 (*J. Ogilvie*).

Closely related to *H. livingstonei* Ckll., from Victoria Falls, but easily distinguished by the two large tubercles on clypeal margin, the elongate quadridentate mandibles, and the orange ventral scopa. Also, the abdominal hair-bands are broader, though slender.

Heriades communis Cockerell.

Belgian Congo (Katanga): Tenke, July-Aug., common (*A. Mackie*, *W. P. Ckll.*, *Ckll.*, *J. Ogilvie*); Katentwe near Dilolo, July 27 (*A. Mackie*); Elisabethville, Sept. 17 (*J. Ogilvie*); Katanga Mission, Sept. 17 (*J. Ogilvie*, *L. Ogilvie*); Kafubu Mission, Sept. 19 (*A. Mackie*); also at Uvira, at the north end of Lake Tanganyika, Aug. 29 (*J. Ogilvie*); Albertville, Sept. 1 (*J. Ogilvie*, *A. Mackie*); Kabalo, Aug. 15 (*J. Ogilvie*); Tshibinda, Aug. 21-27, female with hair at sides of face not dense (*J. Ogilvie*); Sakania, Sept. (*J. Ogilvie*, *A. Mackie*).

Heriades globiventris Friese.

S. Rhodesia: Matopo Hills, April 17-30, 1932, 7 ♀, 4 ♂ (*A. Mackie*, *J. Ogilvie*, *L. Ogilvie*).

This is the smaller of the two species common in the Matopo Hills, with shining area of metathorax, wings variable from clear to brownish, first recurrent nervure near base of second cubital cell. It is the *H. scutellatus* Friese, 1924, of which *globiventris* was regarded as a variety. I do not find the ventral scopa differently coloured from that of true *H. scutellatus*. It is possible that there are

two species involved, but at present I cannot clearly separate them (see Ann. & Mag. Nat. Hist., Sept. 1932).

Heriades hercules Strand.

♀.—Length about 7.5 mm., anterior wing 6.

Robust, black, including mandibles, antennæ (which are rather long for a female), tegulæ, and legs; axillæ unarmed; wings strongly darkened; ventral scopa white.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (J. Ogilvie).

This agrees with one from Mt. Ruwenzori, and is remarkable for the ample darkened wings. The mesothorax is more finely punctured than in *H. chubbi* Ckll.

Heriades (Noteriades) heterostictus, sp. n.

♀.—Length about 6 mm., anterior wing about 4.2.

Black, including mandibles, antennæ, and tegulæ; dense white hair at sides of face, extending part way up front, but none on clypeus; a large crescentic patch of dense white hair in front of tegulæ and a transverse band below wings; mandibles broad, with a broad concave cutting-edge, and at apex two short obtuse teeth; clypeal margin quite simple, thickened; clypeus with a strong keel running its whole length, on each side of lower part of keel is a large square area with the surface extremely densely minutely punctured, but otherwise the clypeus has very large partly confluent punctures; lower margin of supraclypeal area with a shining band interrupting the keel; lateral keels above clypeus little divergent; front and vertex very coarsely and densely punctured, a shining spot laterad of each lateral ocellus; mesothorax and scutellum very coarsely punctured, hardly shining, the large punctures on disc of scutellum peculiar for having a circular opaque disc; a white hair-band, narrowly interrupted in middle, between mesothorax and scutellum; posterior corners of mesothorax not at all produced. Wings hyaline, slightly suffused with brown; stigma rather large, very dark, nervures dark brown; basal nervure meeting the very oblique nervulus; second cubital cell receiving first recurrent nervure about as far from base as half length of intercubitus, the second near apex. Legs black, hair on inner side of tarsi reddish. Abdomen short and stout,

the first three tergites with white hair-bands, the first broadly interrupted in middle; a slender white hair-band also next to the sharp margin of basin of first tergite; ventral scopa entirely white. The scutellum has a projecting sharp edge and punctures much larger than on mesothorax.

S. Rhodesia: Matopo Hills, April 17–30, 1932 (*J. Ogilvie*).

Nearest to *H. chapini* Ckll., which it resembles in many respects, but it is much smaller, with peculiar sculpture as described.

Heriades mackieæ, sp. n.

♀.—Length about 7.5 mm., anterior wing 5.5.

Black, robust, shining, and strongly punctured, the large punctures on top of head like those on mesothorax and scutellum, the abdominal punctures a size smaller; pubescence pure white, long and dense on sides of face and on clypeus except a large median triangular area, the base of the triangle on upper margin of clypeus; the very broad cheeks beneath with a fringe of very long white hair; exposed part of clypeus with punctures in oblique rows; mandibles black, with the inner tooth rudimentary; antennæ black, the flagellum faintly brownish beneath, short, not reaching tegulæ (compare *H. abessinicus* Friese), scape minutely striate-punctate; vertex shining between the large punctures; a slight ridge running from each lateral ocellus in the direction of the median one; cheeks with a sharp margin behind; mesothorax anteriorly with a distinct median groove; scutellum large and with a similar groove; axillæ large, triangular, not spined; tegulæ shining black. Wings hyaline, feebly stained with reddish in and about the cells; stigma moderately large, very dark reddish, nervures dark brown; basal nervure meeting nervulus, which is oblique, so as to continue in a line with basal; second cubital cell receiving recurrent nervures close to and equally distant from base and apex. Legs black, with white hair, a little reddish on inner side of tarsi. Abdomen very stout, curved, well punctate, without cross-sulci; first tergite with a sharply margined basal area; tergites 1 to 5 with very slender but distinct and continuous pure white hair-bands; margins of tergites 5 and 6 denticulate; sternites coarsely punctured; no ventral process.

S. Rhodesia : Belt Bridge, April 12, 1932 (*Alice Mackie*).

A very distinct species, on account of the abdominal structures, probably forming a distinct subgenus. The shining thorax, with well-separated coarse punctures, at once separates it from the superficially similar *H. marleyi* Ckll.

Heriades marleyi Cockerell.

Natal : Greytown, Oct. 20 (*A. Mackie*) ; National Park, March 3-15 (*J. Ogilvie*).

Females, the first with grey, the second with brown, wings, but apparently the same species. In the type of *H. marleyi* and in the National Park specimen the scutellum is densely punctured, but in the Greytown one it is anteriorly polished, with well-separated punctures. The Greytown specimen also differs from the other two in having the first recurrent nervure much nearer the base of second cubital cell, the cell receiving the recurrent nervures at equal distances from base and apex. It is possible that the Greytown form should be separated as a race or species, but more material is needed.

Heriades matopensis, sp. n.

♂.—Length about 4 mm., anterior wing 3.

Black, moderately robust, with a broad-oval head, the facial quadrangle much longer than wide ; antennæ black, the scape rather stout, and covered with fine appressed hairs ; clypeus and sides of face covered with pure white hair ; mandibles black ; supraclypeal area and front dull, region behind ocelli shining and with strong punctures ; in lateral view of head the cheeks are not as wide as eyes ; sides of thorax with white hair ; disc of mesothorax shining, with strong punctures ; scutellum highly polished, with well-separated punctures ; axillæ with short stout spines ; tegulæ shining black. Wings dusky hyaline ; stigma very dark, nervures brown ; basal nervure falling short of nervulus ; second cubital cell receiving recurrent nervures at extreme ends. Legs black, with thin white hair. Abdomen as usual in the genus, the second tergite with a linear white band, the bands on the other tergites indistinct ; punctures of abdomen very little smaller than those of thorax ; punctures of mesopleura very large ; no ventral prominence on abdomen, and last tergite unarmed.

S. Rhodesia: Matopo Hills, April 17–30, 1932 (*J. Ogilvie*).

The margin of the clypeus is truncate and entire; this and the stout axillar spines distinguish it from *H. centralis* Benoist, from Kindu, on the Lualaba River, which is nearly as small. The narrow face is the most conspicuous distinguishing character; in *H. bevisi* Ckll. the head is circular seen from in front. There is a small spot of white hair at each side of first tergite; in the equally small *H. larvatus* Friese the first three tergites have lateral spots. *H. ciliatus* Friese, from Zululand, has a long head, but the margin of clypeus is crenulated. The head closely resembles that of *H. campanularum* (Kirby) of Europe, but the thorax is quite different. *H. perminuta* Ckll., from the Kalahari region, differs conspicuously in the venation, and the head is circular seen from in front. A characteristic feature of *H. matopensis* is the fringe of long erect white hairs along hind margin of scutellum.

A second specimen, regarded as a variation of *H. matopensis*, comes from the De Beers Ranch, Shangani, May 8–12 (*L. Ogilvie*). It is about 5.3 mm. long and has white hair-bands on the first two tergites. The white hair of the clypeus is thin, but that of sides of face is dense and pure white as in *H. larvatus* Friese, which, however, has longer antennæ.

A female *H. matopensis* from the Matopo Hills (*L. Ogilvie*) closely resembles the male, except in the usual sexual characters. It is little over 4 mm. long, with a pure white ventral scopa. The mandibles are tridentate; the clypeus has a simple straight margin, but its sculpture is peculiar, about the lower third being densely very minutely punctured, while the upper two-thirds have very coarse punctures, tending to run in vertical rows. The first three tergites have white hair-bands, weak in middle and interrupted on first; the following two are very thinly white pruinose. The sides of face are densely covered with white hair. The area of mesothorax is polished, which is not the case in *H. larvatus* Friese.

Heriades microstictus, sp. n.

♀.—Length about 5.3 mm., anterior wing 3.3.

Rather slender, black, including mandibles, antennæ (flagellum very faintly brownish beneath), tegulæ (slightly brownish), and legs (the tarsi a little brownish apically);

pubescence rather dull white, the ventral scopa comparatively short and entirely white; head circular seen from in front; sides of face with white hair and a white fringe on cheeks below; mandibles broad, the inner corner approximately rectangular, the cutting-edge with two stout teeth and a simple inner portion; clypeus dull and densely punctured, its upper end more shining, clypeal margin with a widely spaced row of very minute tubercles; front and vertex dull and densely punctured, no smooth spots next to ocelli; mesothorax and scutellum very finely and densely punctured, the disc of scutellum shining, the punctures not so dense; a band of white hair from tubercles over tegulæ and around hind margin of scutellum, where it is long and abundant. Wings greyish; stigma small, very dark, nervures dark; basal nervure meeting nervulus; second cubital cell receiving first recurrent nervure near base and the second more distant from apex. Legs with white hair, light reddish on inner side of tarsi. Abdomen finely punctured, moderately shining, the first three tergites with entire white hair-bands, the others (thinly on fourth) with fine whitish pile; no transverse sulci.

The basin of first tergite is not sharply defined; this character, the small stigma, and small close punctures of thorax exclude the species from typical *Heriades*. It is probably more nearly allied to *Chelostoma*, which European authors include in *Heriades*.

S. Rhodesia: Matopo Hills, Oct. 1, 1932 (*J. Ogilvie*).

In the fauna of the region it is readily separated from *H. ornaticornis* Ckll., *H. scutellatus* Friese, and *H. globiventris* Friese by the very finely and densely punctured mesothorax. In the European fauna it would fall next to the much larger *H. fuliginosus* Panzer.

Heriades nitescens Cockerell.

Belgian Congo: S. of Bukavu, Aug. 28, 1 ♀ (*A. Mackie*).

The axillæ are strongly spined and the ventral scopa is pale orange.

Heriades ornaticornis, sp. n.

♀ (type).—Length 5.5 mm., anterior wing 3.8.

Robust, black, axillæ without spines; head circular seen from in front; clypeus and sides of face with long white or slightly fulvescent hair; mandibles entirely

black; clypeus simple, the upper part visible, showing a shining surface with coarse punctures, and the supra-clypeal area the same; vertex very densely and strongly punctured; antennæ moderately long, very slender, the flagellum clear red beneath, dusky red above except the last four joints, which are black, abruptly contrasting; cheeks beneath with a dense brush of pure white hair, much longer posteriorly; mesothorax and scutellum strongly punctured, glistening, the punctures of the same size as on vertex and abdomen; scutellum with very long white hair, but thin, not hiding the surface; base of metathorax polished; sides of thorax with much white hair; tegulæ shining black. Wings hyaline, with brown stigma and nervures, the stigma quite small; basal nervure in a line with the oblique nervulus; second cubital cell receiving recurrent nervures near ends, but not at the corners. Legs black, with white hair, very long glistening white hair on under side of hind tarsi. Abdomen robust, basin of first tergite deep and sharply defined; tergites 1 to 3 with slender white hair-bands, broadening at sides; fourth and fifth with thin white pile; no ventral process, but second sternite convex; apical sternites (commonly concealed) red.

♀.—Length 5.6 mm., anterior wing 3.6 mm.

Ventral scopa white; a row of pits at base of metathorax as in *H. argentatus* Gerst. The flagellum has the middle portion dusky red beneath. Mandibles tridentate; margin of clypeus quite simple. Extreme sides of face with dense white hair.

S. Rhodesia: Matopo Hills, April 17–30, 1932, 3 ♂, 1 ♀ (*A. Mackie, J. Ogilvie, L. Ogilvie*).

Unique by the peculiarly coloured antennæ of the male, but allied to *H. albiscopanus* Strand, which has the flagellum all brown beneath and the tarsi brownish. *H. wellmani* Ckll., ♀, is less robust, with the antennæ all dark.

Heriades pellucidus Cockerell.

S. Rhodesia: Matopo Hills, Oct. 1931 (*J. Ogilvie*).

One male, which differs from the type (from Natal) by the densely punctured scutellum and the band on first tergite continued as a slender line right across. The clear wings, venation, and other characters are typical

of *H. pellucidus*, and if there is a distinct race it must be supported by more material.

Heriades sakaniensis, sp. n.

♀.—Length about 7 mm., anterior wing 5.

Black, robust, with mostly white hair, the ventral scopa white, but the abundant long hair on clypeus faintly yellowish and the apical part of the broad mandibles with appressed pale yellow pile; mandibles tridentate, the cutting-margin hardly at all oblique; clypeus entirely dull, very minutely sculptured, except the thickened shining margin, which is slightly curved, not straight; front dull and excessively densely punctured, not sulcate in middle; vertex with very large well-separated punctures on a shining ground; mesothorax punctured like vertex, the disc polished and the punctures quite widely separated; scutellum more densely punctured; axillæ not spined; base of metathorax dull; tegulæ reddish brown, the margin narrowly pallid. Wings greyish, strongly dusky; basal nervure meeting nervulus; second cubital cell receiving first recurrent nervure far from base (the distance about equal to second cubital on marginal), the second much nearer apex. Legs black, with white hair, slightly fulvescent on inner side of tarsi; hind basitarsi broad. Abdomen broad, convex, shining, well punctured, with narrow apical hair-bands on first three tergites and traces on fourth and fifth; ventral scopa white.

Belgian Congo (Katanga): Sakania, Sept. 1931 (*L. Ogilvie*).

Related to *H. chubbi* Ckll., from Natal, but differing in the clypeus and mandibles, the broader head and much more massive vertex, and the brown tegulæ. The shining yellow pile on the mandibles is especially distinctive, and another feature is the shining raised line down the middle of the supraclypeal area.

Heriades scutellatus Friese.

S. Rhodesia: Matopo Hills, April 17–30, 1932, 9 ♀, 5 ♂ (*A. Mackie*, *J. Ogilvie*, *L. Ogilvie*).

This is the larger of the two species common in the Matopo Hills, with dull area of metathorax, brownish wings, first recurrent nervure distant from base of second cubital cell. It is the *H. scutellatus* Friese, 1922, not 1924.

Heriades sulcatifrons, sp. n.

♀.—Length about 8 mm., anterior wing about 4.5.

Long and rather narrow, black, including mandibles, antennæ, and legs, the tegulæ with a somewhat reddish margin; wings strongly reddened except at base. Head somewhat oblong, the facial quadrangle longer than broad, but the face about 1.4 mm. broad; mandibles stout, with a long oblique cutting-edge which is obscurely quadridentate; margin of clypeus with a series of small rounded shining tubercles; surface of clypeus finely and densely sculptured, malleate; front with large punctures on a shining surface and a conspicuous median sulcus; a patch of white hair at each side of face; vertex and mesothorax with similar very coarse punctures, on mesothorax except posterior middle very dense, and running more or less in rows; scutellum polished, the punctures well separated; axillæ pointed, but not spined; base of metathorax smooth and polished; sides of thorax with very thin short white hair. Stigma large and very dark, nervures dark brown; basal nervure meeting nervulus; second cubital cell receiving first recurrent nervure far from base (the distance equal to about two-thirds of intercubitus) and second scarcely half as far from apex. Legs with thin white hair, red on inner side of tarsi; spurs pale red. Abdomen strongly punctured (but not so coarsely as thorax), the basin of first tergite shallow but sharply defined; no hair-bands, but thin white hair at sides, and the fifth and sixth tergites (the latter more densely) with fine pruinose pubescence; ventral scopa shining white.

S. Rhodesia: Matopo Hills, April 17–30, 1932 (*L. Ogilvie*).

In the fauna of the region it may be compared with *H. livingstonei* Ckll. from Victoria Falls, but that has an entirely different (convex and shining) clypeus, no sulcus on front, and much more finely punctured abdomen.

Heriades (Noteriades) tricarinatus (Bingham).

♂.—Length 6–7 mm., anterior wing 5.

Rather robust, black, the greater part of the mandibles dark blood-red, or, rarely, the mandibles almost entirely black; antennæ black, very long, the flagellum reaching the metathorax; last joint of maxillary palpus very long and bristly; a strong keel extending the whole length

of clypeus and extending up to level of antennæ; lateral keels above clypeus strongly diverging; sides of face with dense pure white hair, and this extends to cover the lateral thirds of clypeus; mesothorax shining on disc between the very large punctures, its posterior lateral corners produced; a band of dense pure white hair, interrupted in middle, between mesothorax and scutellum; scutellum extremely coarsely and confluent punctured; area of metathorax dull and granular; tegulæ black, punctured all over. Wings dusky; stigma well developed, very dark; basal nervure falling short of nervulus; second cubital cell receiving recurrent nervures equally distant from and close to base and apex (in some from Tenke the wings are clear hyaline, with a little cloud beyond end of marginal cell), the first recurrent nervure is more distant from base of second cubital cell, and the second recurrent meets outer intercubitus, while the tarsi are variably reddened. Legs black, a little reddish apically, spurs pale reddish, hair on inner side of tarsi reddish. Abdomen stout, curved, the tergites with pure white hair-bands, the punctures much smaller than those on mesothorax. The clypeal margin is simple, appearing slightly undulate under the microscope.

Belgian Congo (Katanga): Bianco, Aug. 8-11, 1931 (*J. Ogilvie*).

This is the one described, but there are five from Tenke, July 30-Aug. 9, 1931 (*J. Ogilvie*), mostly varying as indicated above; also eight from Elisabethville, Sept. 11-17, 1931 (*J. Ogilvie*, *L. Ogilvie*), mostly like the Tenke ones.

In my table in 'American Museum Novitates,' no. 615 (1933), this runs near *H. clypeatus* Friese, from which it is separated by the black tegulæ or otherwise, to *H. tricarinatus* (Bingham), from which it is known by the red on mandibles. *H. capensis* Friese, which notwithstanding its name is from S. Rhodesia, is described as like *H. clypeatus*, but clypeus with simple margin, and mandibles red in female, black in male. We are left to infer that the tegulæ are as in *H. clypeatus*. *H. tricarinatus* was described from Pretoria, and has only been known in the female. I have two males from Greytown, Natal, Oct. 20, 1931 (*A. Mackie*, *L. Ogilvie*), and they have dusky reddish mandibles. The venation is

like that of the Tenke variety cited above. I can only conclude that the Katanga insect described above is the hitherto unknown male of *H. tricarinatus*, as it essentially agrees with the Natal males.

Lithurgus bamangwatonis, sp. n.

♀.—Length about 11 mm., anterior wing 7·4.

Black, with thin black ventral scopa; hair of head mostly white (long on cheeks below), but clypeus with a long yellowish fringe, red hairs on lower margin of mandibles, and a band of black hair across vertex; mesothorax glistening, transversely rugose, not hairy; scutellum dull and minutely rugose; tubercles with pure white hair, but mesopleura with thin dark grey hair; tegulae black. Wings dusky hyaline, second cubital cell not very long, receiving recurrent nervures equally distant from (and not far from) base and apex. Basitarsi with long black hair; small joints of tarsi reddish. Abdomen polished, tergites 1 to 4 with slender pure white hair-bands, on first reduced to a little patch at each side and on the others broadly interrupted or weakened; hair at apex black, dark red in middle. The very short flagellum is obscure reddish beneath; the clypeus is glistening and rugose, with an obtuse transverse elevation on its upper part.

Bechuanaland: Palapye Road, March 4, 1934 (*L. Ogilvie*).

Close to *L. livingstonei* Ckll., but smaller, with dusky wings and different venation, and abdominal bands slender.

Parafidelia cinerea, sp. n.

♀.—Length about 18·4 mm., anterior wing 13·3.

Black, the strongly bifid mandibles reddish in middle and yellowish white at base, the clypeus with a yellowish-white marginal band, rather broadly interrupted in middle; flagellum dusky reddish beneath except basally; tegulae very dark brown; anterior wings dusky hyaline, abruptly darker beyond the cells. Labrum shining; clypeus entirely dull; last joint of maxillary palpi slender, much longer than penultimate, the other joints stout, the third much longer than the fourth; last joint of labial palpi broadly rounded at end; third antennal

joint longer than next two combined ; hind claws simple, but front claws with a sharp inner tooth. Hair of head and thorax white, a dark brown outstanding fringe between antennæ, and a similar one in region of ocelli ; ocelli large, in a curved line ; sides of vertex polished ; mesothorax strongly keeled in middle except posteriorly, the silky pubescence appressed and directed mesad ; surface of mesothorax and scutellum dull ; a faint fulvous tint in the pubescence in front of the tegulæ ; all the tarsi with black hair, the hind basitarsi very large and broad ; hind tibiæ with mainly black hair, but white at base above ; hind femora with white hair ; middle femora with a patch of red hair at base beneath. Abdomen partly shining, first tergite with much white hair, tergites 2 to 4 with a crescentic band of long white hair on each side, fifth with an entire band ; apical plate large, dull, black, broadly rounded at end ; venter with long pure white hair.

Bechuanaland : Palapye Road, March 6, 1934 (*L. Ogilvie*).

A very fine species, easily known by the large size and cinereous appearance of the pubescence. It is nearest to *P. friesei* Brauns, but differs in the colour of the pubescence, the clypeal markings, &c. The tarsi are not yellowish, but obscurely rufescent apically. The insect is not so robust as *P. friesei*, and the latter has the hair of hind legs all black.

Notomelitta politissima Cockerell.

This was described (1934) from the female, Natal National Park (*J. Ogilvie*). I find I have a male with the same data. It is about 10 mm. long, not so robust as the female ; thorax with abundant long hair, all white ; antennæ long, black ; second and following tergites with conspicuous white hair-bands ; apical plate broadly truncate ; hind tibiæ at end and the broad hind basitarsi red. The sides of the vertex are brilliantly polished.

Meliturgula hæmatospila ogilviei, subsp. n.

♀.—Length about 7·7 mm.

Face-markings and antennæ as in the type-form ; wings perfectly clear, with paler veins ; hind tibiæ and tarsi light red ; first three tergites clear pale ferruginous,

except a black spot at each side of second; fourth tergite red, with an ill-defined blackish cloud across the middle; fifth black.

Cape Province: Upington, Dec. 7, 1933 (*J. Ogilvie*).

Possibly only an extreme colour-variation.

Habropoda festiva Dours.

Orange Free State: Donkerpoort, April 18, 1934, ♀ (*J. Ogilvie*).

XXXIV.—*A new Ascarid from a Bat.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

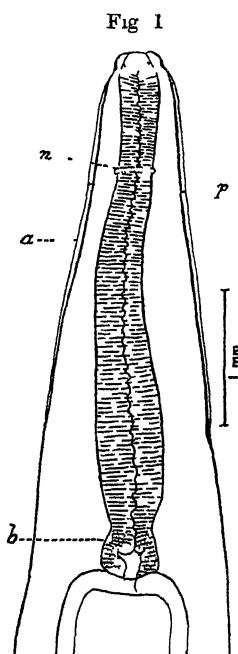
DURING the Oxford University expedition to the New Hebrides, 1933, a number of Ascarids were collected by Dr. J. R. Baker from the alimentary canal of a suckling fruit-bat (*Pteropus geddiei*) at Hog Harbour, Espiritu Santo. The worms appear to represent a new species of *Toxocara*. The type-specimens are in the British Museum (Natural History).

Toxocara pteropodis, sp. n.

The males measure about 70–80 mm. in length and 1.5–1.8 mm. in maximum thickness, the females about 90–120 mm. and up to 2.5 mm. respectively. The cuticle has rather coarse transverse striations. The intervals between these are greatest in the posterior half of the body, where in males they reach 30–40 μ and in females 40–50 μ . There is no constant curvature of the anterior end towards the ventral side, as is usual in *Toxocara*. The lips are relatively short and broad, and there are no interlabia. The pulp of each lip (fig. 2) has two outer lobes and a large inner lobe. All three lobes are rounded in outline, but the outer lobes are produced anteriorly into irregularly shaped processes originating from their inner surfaces. These processes converge somewhat towards the middle line of the lip. The dorsal lip bears a pair of large double papillæ, each subventral lip a large papilla towards the ventral and

a small papilla towards the lateral margin. Each lip has a marginal dentigerous ridge.

There is a pair of very narrow lateral cervical alæ (fig. 1, *a*), extending for about the anterior three-quarters of the oesophageal region. In these alæ, at a distance of 0.75–1 mm. from the anterior extremity, there is a pair of small and inconspicuous cervical papillæ (fig. 1, *p*). The excretory pore is at approximately the same level,



Toxocara pteropodis. Anterior end of female;
dorsal view.

a., cervical ala; *b.*, oesophageal bulb; *n.*, nerve-ring;
p., cervical papilla.

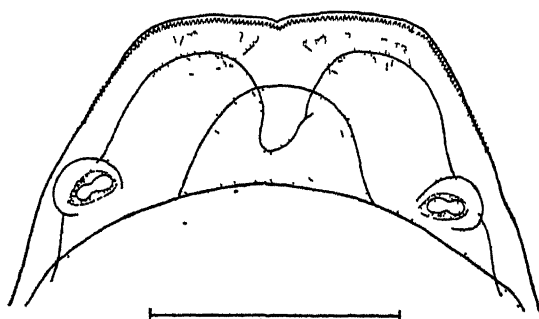
and the nerve-ring is situated about 0.1 mm. more anteriorly.

The oesophagus, measured from the anterior extremity, is 2.75–4.1 mm. long. It increases gradually in diameter posteriorly, but near its posterior end there is a slight constriction, marking off a small, subglobular, muscular

bulb (fig. 1, *b*), of smaller diameter than the preceding portion of the œsophagus proper. The bulb measures 0.3–0.42 mm. in length and 0.32–0.47 mm. in width, and appears to contain the valvular structure through which, in most Nematodes, the œsophagus opens into the intestine.

The tail, in both sexes, has a minute terminal spike. The tail of the male (fig. 3) is 0.25–0.35 mm. long, and shows a slight constriction at about its middle, marking off the posterior "digitiform appendage" characteristic of the genus *Toxocara*. The constriction, however, is very faintly marked in some specimens. The postanal papillæ are typical in number and arrangement, *i. e.*, they

Fig 2.



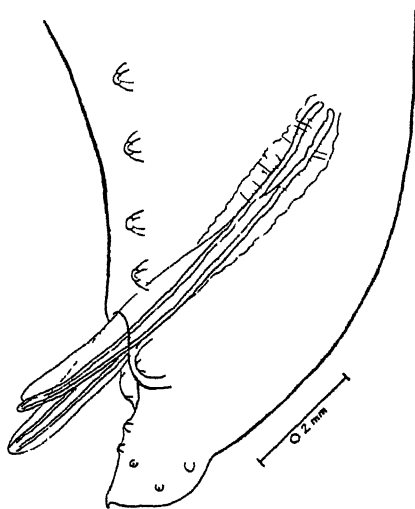
Toxocara pteropodis. Dorsal lip of male,
viewed from the exterior.

consist of a pair of large, apparently double, papillæ between the cloacal aperture and the caudal constriction, and five pairs of smaller papillæ behind the constriction. Two of these are subventral, one lateral and two subdorsal. The preanal papillæ appear to consist of 19 pairs, those of each side forming a regular and simple row. The cuticle of a considerable part of the ventral and lateral surfaces of the caudal end of the male is longitudinally and transversely furrowed, so that it has a tessellated appearance. The tessellated area extends across the ventral surface at the caudal constriction, and forward from this point for a considerable distance in front of the cloaca, leaving only a small patch of

smooth cuticle immediately surrounding the cloacal aperture.

The spicules are relatively short and stout, and each is provided with a pair of alæ which curl over its ventral surface. They are subequal and vary between about 0.6 mm. and 0.8 mm. in length. The muscular ejaculatory duct extends forward to about the middle of the body, and the coils of the testis to within about 10–20 mm. of the anterior extremity.

Fig. 3.



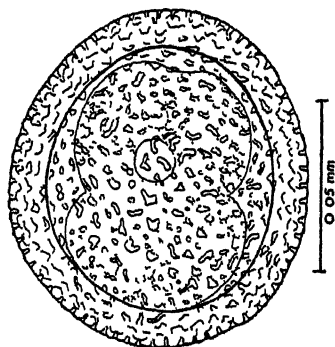
Toxocara pteropodis. Posterior end of male;
lateral view.

In the female the tail measures 0.45–0.75 mm. in length, and is bluntly rounded at the extremity, except for the small terminal spike. The caudal papillæ are situated laterally near the tip. The vulva, which is not prominent, is situated at about 15–20 mm. from the anterior end of the body. The vagina is long, narrow and muscular, and is usually much coiled. The coils of the paired genital tubes extend posteriorly to within about 3–12 mm. from the caudal end. The eggs (fig. 4) are of rounded-

ovoid or subglobular shape, and measure 0·088–0·112 mm. in greatest diameter. Their shells are very thick (10–14 μ), and have their surfaces covered with pits of irregular shapes. The contents of the eggs are in early stages of segmentation *in utero* (in specimens fixed in Bouin's fluid).

The genus *Toxocara* contains at present only three well-authenticated species, viz., *T. canis* (Weiner, 1782) [= *Belascaris marginata* (Rud., 1802) Railliet and Henry, 1911], occurring in Canidæ; *T. mystax* (Zeder, 1800) [= *Belascaris cati* (Schränk, 1788) of some authors], in Felidæ; and *T. melis* (Geddoelst, 1920) in the badger. Other species have been attributed to the genus, but are

Fig. 4.

*Toxocara pteropodis*. Egg.

of doubtful status. *T. crenulata* (Bremser, 1824) is, in the writer's view, probably a synonym of *T. mystax*, and *T. vulpis* (Frölich, 1789), *T. triquetra* (Schränk, 1790) and *T. masculior* (Railliet and Henry, 1911) synonyms of *T. canis*. The *Strongylus elephanti* of Rudolphi, 1819 (= *Ascaris lonchoptera* Diesing, 1851), from the Indian elephant, possibly belongs to the genus, but is so imperfectly known that it must, for the present, be left out of consideration.

The species here described differs from *T. canis* and *T. mystax* notably in the extreme narrowness of the

cervical alæ, and also in the shortness of the spicules of the male. In *T. canis* the spicules measure, according to different authors, from 0.74 to 1.05 or even 1.3 mm. in length, and in *T. mystax* from 1.63 to 2.2 mm. (the maxima in both cases are given by Yamaguti (1935) for Japanese specimens). According to Taylor (1924) the intervals between the cuticular striations in both *T. canis* and *T. mystax* do not exceed 37 μ . The eggs in both these species are also smaller than in the present form.

T. melis apparently has narrow cervical alæ, but is a large form, measuring up to 124 mm. in length and 3 mm. in thickness in the male and 260 mm. and 4.5 mm. respectively in the female. The male has spicules 0.88 mm. long, and is described as having only four (instead of six) pairs of postanal papillæ, and no less than 63 pairs of preanal papillæ.

Only one Nematode which seems likely to belong to the family Ascaridæ appears to have been recorded from a bat*. This is *Ascaris cynonycteridis* Parona, 1889, and it is interesting to note that it was, like the present specimens, obtained from a suckling individual. The host was *Xantharpyia* [*Cynonycteris*] *amplexicaudata*, and the locality Burma. From Parona's description it is clear that his species is quite different from *T. pteropodis*, and there is no evidence that it is a *Toxocara*. The male is described as having only one pair of postanal and four pairs of preanal papillæ.

REFERENCES.

- GEDOELST, L. 1920. "Sur une Espèce nouvelle d'Ascaride, Parasite du Blaireau." *Compt. rend. Soc. Biol., Paris*, lxxxiii. pp. 1291-1292.
- PARONA, C. 1889. "Sopra alcuni Elminti di Vertebrati Birmani, raccolti da Leonardo Fea." *Ann. Mus. Civ. Stor. Nat. Genova*, xxvii. pp. 765-780, pl. iii.
- TAYLOR, E. L. 1924. "On the Ascarids of the Dog and Cat." *Ann. Trop. Med. & Parasitol.* xviii. pp. 243-251.
- YAMAGUTI, S. 1935. "Studies on the Helminth Fauna of Japan.—Part 13. Mammalian Nematodes." *Jap. Journ. Zool.* vi. pp. 433-457.

* *Ascaris vespertilionis* Gmelin, 1790, is a *nomen nudum* apart from the mention of the host, *Vespertilio auritus*.

XXXV.—On a new Subspecies of *Mesembriomys hirsutus* from Melville Island. By R. W. HAYMAN. From the Department of Zoology, British Museum (Natural History).

THE British Museum has recently received from the Zoological Society of London the body of an Australian Hairy Rat from Melville Island, Northern Territory, one of four exhibited at the Gardens under the name *Mesembriomys hirsutus* Gould, a species which has not hitherto been recorded elsewhere than from the mainland of Northern Australia. Comparison of the skin and skull with the typical *M. hirsutus* Gould (Proc. Zool. Soc. 1842, p. 12) from the Northern Territory mainland, and its subspecies *rattoides* Thos. (Ann. & Mag. Nat. Hist. ser. 9, vol. xiii. p. 296, 1924) from Cape York Peninsula, shows differences sufficient to justify the separation of this island form as a new subspecies, for which I now propose the name *melvillensis*.

Size and proportions much as in *hirsutus*, but with back much more heavily washed with black, black muzzle, black feet (the hind feet entirely lacking the irregular blotching of cream and/or brown found in the two forms previously known), and underside differing very slightly in colour from the sides of the body. In *hirsutus* the whole underside is whitish or creamy, and in *rattoides* it is dull slaty grey.

Type.—Adult male skin and skull. Collected in 1935 on Melville Island, Northern Territory, Australia, by Walter Goodfellow. Presented by the Zoological Society of London, November 1935. B.M. no. 35.11.30.1.

Description of Type.—General colour above a grizzled mixture of buff and black. The hairs are slaty at the base and mostly buffish terminally, mixed with a moderate proportion of black-tipped hairs over the greater portion of the body, an area commencing behind the shoulders and spreading over the back and rump being heavily overlaid with long black-tipped hairs (about 35 to 40 mm. in length) having their middle section buffish. There are also in the dorsal area a number of long hairs entirely black. On shoulders and flanks the buff predominates, still mixed with black-tipped hairs, and this grizzled

colour passes below on to all that part of the ventral surface behind the front legs and in front of the genital area. The ventral hairs are, however, shorter, and the slaty bases are a little more conspicuous in consequence. In the middle line of the ventral area the buff is slightly brighter. On the throat, chest, and the genital region silvery-grey hairs predominate mixed with scanty blackish hairs, these areas contrasting with the grizzled buff of the rest of the ventral surface. Above, the muzzle as far back as halfway to the eye, with the tip of the lower lip, is quite black, as are also the ears and the upper surface of hands and feet. There are no white hairs at the base of the claws in either hands or feet. The cheeks, together with a patch in front of the eyes, are greyish, while the top of the head between eyes and ears is heavily washed with black. The nape of the neck is a rather bright ochraceous buff thinly mixed with black, fading away into the paler buff mixed with black of the shoulders. The tail is black-haired above and below except for the terminal two inches of pure white ending in a slight tuft.

The skull resembles that of *M. hirsutus* with one conspicuous difference. The front edge of the ante-orbital plate, instead of projecting strongly forward before turning downwards as in adults of the mainland forms, is without the forward projection and turns downwards almost at once. Hence the plate is considerably shorter from back to front than in the forms hitherto known. Since, however, in immature skulls of the mainland forms the ante-orbital plate is without the strong forward projection, it may be possible that captivity may have affected development in the single skull examined.

Dimensions of Type.—Head and body 280 mm.; tail 346; hind foot 63; ear 44. Skull-measurements: greatest length 63.2 mm.; condylobasal length 60.2; zygomatic breadth 30.7; interorbital breadth 10.1; breadth of brain-case 19.4; length of nasals 24; palatilar length 32.4; length of palatal foramina 10.8; length of cheek-teeth series 10.8; breadth of m^1 3.2.

Thanks to the courtesy of Mr. D. Seth Smith, Curator of Mammals and Birds, I have been given an opportunity of examining three additional examples of this race living in the Zoological Gardens. They agree well with

the type in principal external characters, the dark muzzle and dark grizzled underside being characteristic. One, however, had a few white hairs at the base of some of the front claws.

It is interesting to find an island race of this large rat differing so markedly from the mainland form *hirsutus*, of which the type-locality, Port Essington on the Cobourg Peninsula, is comparatively near to Melville Island.

XXXVI.—*New Records and new Species of Elaterid Beetles from Melanesia.*—II. By R. H. VAN ZWALUWENBURG, Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, T.H.

THROUGH the courtesy of the Imperial Institute of Entomology, and of Mr. R. J. A. W. Lever of Tulagi, British Solomons, some recently collected Elaterid material from the Bismarck Archipelago, the Admiralty Archipelago, and the Solomon Islands, has been received for examination. Among the specimens are three new species and numerous new distribution records. This opportunity is taken to list also a few new records from Polynesian islands.

Lacon modestus (Boisduval).

Puako plantation, near Kawaiāhae, Island of Hawaii, March 1905 (*O. H. Swezey*). The only island of the Hawaiian group from which this immigrant species has hitherto been recorded is Oahu.

Agrypnus soricinus Candèze.

Manus Island, Admiralty Group, 1. xi. 1933 (*B. A. O'Connor*, no. C 719 x). This species occurs also in New Britain and New Guinea.

Adelocera gracilenta (Schwarz).

The following new records, all from the Solomons, can be added to the range of this species, hitherto known from the Bismarck Archipelago and from Tulagi and Guadalcanal in the Solomons:—

Su'u, Malaita, 24. vi. 1934 (*R. J. A. W. Lever*); Haivo, Sta. Isabel (Ysabel) (*R. A. Lever*), ii. 1933; Fulakora,

Sta. Isabel, ii. 1933 (*R. A. Lever*); Halaita, Nggela Island (Florida), 20. iii. 1934 (*H. T. Pagden*, no. 1107). Two specimens.

Adelocera gracilis (Candèze).

New Hanover, Bismarck Archipelago, 18. v. 1934 (*J. L. Froggatt*, no. C 1000); Su'u, Malaita, Solomons, 24. vi. 1934 (*R. J. A. W. Lever*, no. 3029).

Alaus schwarzi Fleutiaux.

Alaus sulcicollis Schwarz, 1902, nec *A. sulcicollis* Gahan, 1900.

Kieta, Bougainville, Solomons, v. 1934 (*J. L. Froggatt*, no. C 857). Known hitherto from Russell and Shortland Islands.

Alaus tavuvu Van Zwaluwenburg.

Tulagi Ridge, Tulagi, Solomons, 13. viii. 1933 (*H. T. Pagden*, no. 91). This species was originally described from Russell Island in the Solomons.

Dioxypterus bennigseni Schwarz, var.

A specimen, which may be a variety of this New Britain species, was taken on New Hanover, Bismarck Archipelago, 20. v. 1934, by J. L. Froggatt (no. C 1001). It differs from the description of *bennigseni*, specimens of which I have not seen, in having the head and pronotum dark rufous instead of rufo-testaceous, in having the median black band on the pronotum extending the full length of the pronotum instead of only part-way, and in having the yellowish basal half of the elytra of *bennigseni* reduced to a small patch at the base which grades into the black of the rest of the elytra not far behind the scutellum.

Dioxypterus montanus, sp. n.

Female, 14.0 mm. long.

Shiny, except apical half of elytra.

Head orange-red, with small median black spot at base; antennæ black, except for orange-red basal and rufous second joint; pronotum orange-red with lateral bands and a median band broadly, and basal band

narrowly, black; scutellum reddish yellow, margined with black; elytra black with a transverse, more or less posteriorly rounded, yellow area at base, not attaining basal margin or sides, confluent medianly; before the middle another yellow area on each elytron, which fails to attain the suture by about two intervals, and all but attains the lateral margin; on the distal half of the elytra a vaguely defined rufous area, extending forward along the suture, wider behind, not attaining the sides or apical margin. Body beneath reddish yellow with the tips of the posterior angles, the hind margin of the prothorax, and the anterior edge of the mesosternum black; legs reddish yellow, with first four tarsal joints black and the fifth rufous. Pubescence fine, brownish on head, prothorax, and yellowish areas of elytra, blackish on black elytral areas, and ashy on rufous area of elytra.

Front gently convex, medianly flattened on frontal margin where it meets the clypeus; punctation fine and close. Antennæ not attaining tips of posterior angles of prothorax; third joint about twice as long as second, not as wide as fourth; second and third together about as long as fourth; joints 4-10 somewhat serrate; eleventh bluntly rounded at tip. Prothorax longer than wide (median measurements), flattened, especially on basal half, the sides abruptly curved downward; in outline like a truncate cone, strongly and evenly narrowed from base of hind angles almost to the apex, thence more strongly to the anterior margin; posterior angles undulate at base, diverging in general outline of sides of the prothorax, incurved apically; strongly bicarinate, the carinæ subparallel and of about equal length. Pronotum with a median convexity at base, with a suggestion of a fine median carina for a short distance forward of this; punctation fine, close, and lightly impressed, coarser and deeper anteriorly toward the sides. Scutellum convex, elongate-conical; almost impunctate. Elytra about as wide as prothorax, sides parallel to beyond the middle; deeply emarginate at apex with the outer mucronation spinose, the sutural angle very slightly prolonged. Strial punctures fine, lightly impressed on disc, coarser and deeper laterally; intervals convex toward base, very finely and lightly punctulate. Sides

of mucral cavity very prominent, anteriorly reaching a plane conspicuously higher than that of metasternum and abdomen. Abdomen very finely and closely punctulate, thickly covered with short yellowish pubescence.

Described from a holotype female, Popanu, Guadalcanal Island, Solomons, 3000–5000 feet, December 1934 (*C. Bird*, per *R. A. Lever*, no. 4121).

The maculation of the elytra suggests a variety of *D. leveri* Van Zwal.; however, the sides of the mucral cavity are much more prominent than in that species, being similar in this respect to the Fijian *D. guttulatus* Fairm. and *D. flexuosus* Fairm. Furthermore, the pronotum is more flattened on the disc, the sides more convergent, and its proportional length greater than in the female of *leveri*.

Symphostethus pacificus Fleutiaux.

Originally described from Bougainville and Guadalcanal. New record: Suanatali, Dobeli, Vella Lavella, 24. ix. 1933, jungle (*H. T. Pagden*, no. 289). Mr. Pagden also took it at Televo, Guadalcanal, 20. ii. 1934, on wild ginger.

Symphostethus pacificus Fleutiaux, var.

A variety of this species, in which the median black maculation extends without interruption the full length of the pronotum, was taken at Camp 1, Kolombangara Island, Solomons, 12. x. 1933, circa 2500 feet, by *H. T. Pagden* (no. 384).

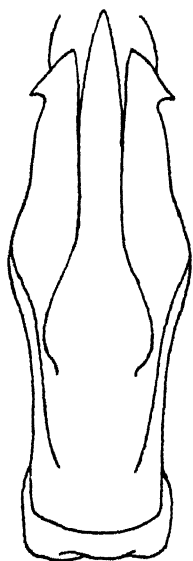
Sphenomerus melanesiensis, sp. n.

Male, 9.5 mm. long.

Subcylindrical, convex, castaneous, with anterior margin of pronotum and basal margin of elytra blackish; legs yellowish. Pubescence short, fine, semi-erect, golden-brown.

Head deeply and densely punctate. Front precipitous, concave with a well-marked median impression about midway between front and rear margins. Frontal margin rounded and subcarinate for its entire distance. Antennæ elongate, exceeding the posterior angles of the prothorax by about three joints; second joint subglobular, third

fully as long as fourth, and all joints beyond the second slender, each at least twice as long as wide. Pronotum coarsely and closely punctate, with punctures becoming finer posteriorly; about as long as wide, strongly convex on anterior half, widely channelled at base; sides straight, slightly convergent anteriorly, narrowed at anterior angles; hind angles slightly more divergent than sides of prothorax, feebly unicarinate. Scutellum more or less pentagonal, concave posteriorly. Elytra at base as wide as hind angles of prothorax; sides subparallel



Ædeagus of Sphenomerus melanesiensis, sp. n.

to about the middle; apex conjointly rounded. Strial punctures fine; intervals convex, finely punctate, rugulose. The lobe of the third tarsal joint is both a little longer and a little wider than that of the second. *Ædeagus* (see figure) with lateral lobes acutely angled.

Described from a holotype male, Tulagi Ridge, Tulagi, Solomons, 25. xi. 1934 (*R. A. Lever and H. T. Pagden*).

Remarkably similar in colour and general habitus to the Philippine *S. bakeri* (Fleutiaux), though more

robust than the male of that species. Other differences are as follows :—

S. bakeri.

1. Antennal joints 3–10 slender, longer than wide. Antennæ exceeding hind angles of prothorax by about 3 joints.

2. Median part of frontal margin rounded.

3. Fronto-clypeal region nearly as high as wide.

4. Strial intervals of elytra finely punctate.

5. Antennal joints 3–10 less cuneate, the posterior thickening being less pronounced.

1. Antennal joints 3–10 very robust, wider than long. Antennæ exceeding posterior angles by less than 1 joint in the male.

2. Median part of frontal margin subtruncate.

3. Fronto-clypeal region relatively less high.

4. Interstrial punctation coarse.

.....

Propsephus compactus Van Zwaluwenburg.

To the range of this species, originally described from Tulagi and Malaita, can now be added the following islands, also in the Solomons :—

Kiwakiva, San Cristobal Island, 7. v. 1934 (*R. J. A. W. Lever*, no. 2668); Santa Ana Island, x. 1932 (*R. J. A. W. Lever*); Malaupaina Island, Three Sisters Group, 13. v. 1934 (*R. J. A. W. Lever*, no. 2766); Ulava Island, 19. v. 1934 (*R. J. A. W. Lever*, no. 2817); Guadalcanal, January and February (*J. A. Kusche*). Two specimens, Bishop Museum collection.

Simodactylus acutus Van Zwaluwenburg.

This species was originally described from Taveuni in the Fiji archipelago. There are two specimens in the Bishop Museum collection: Colo-i-Suva, Viti Levu, Fiji, 20. vi. 1924 (*E. H. Bryan, Jr.*).

Simodactylus cinnamomeus (Boisduval).

This species has a wide range throughout the Pacific islands as far northward as the Hawaiian group. New records :—

Apia, Tutuila, Samoa, xii. 1904, Cornell University collection (*J. T. Lloyd*); Tulagi, Solomons, 30. iii. 1934 (*R. J. A. W. Lever*, no. 1394).

Simodactylus similis Candèze.

A specimen of what appears to be this species was taken at Aola, Guadalcanal, Solomons, iii. 1933 (*R. J. A.*

W. Lever). Previous records have been from Dutch New Guinea, New Britain, and from Manus Island in the Admiralty Group.

Simodactylus tasmani Candèze.

A specimen of this Melanesian and Polynesian species identified by M. Edmond Fleutiaux, is in the Bishop Museum collection: Guadalcanal, Solomons, 2. xii. (J. A. Kusche).

Simodactylus trivittatus Schwarz.

This species was first described from Shortland Island; what I believe to be the same species has been taken as follows:—

Tulagi, Solomons, 2. xi. 1933, at light (*H. T. Pagden*, no. 410); Chinatown, Tulagi, 14. x. 1933, two specimens (*H. T. Pagden*, nos. 232 & 239); Manus Island, Admiralty Group, 24. iii. 1934 (*B. A. O'Connor*, no. C 748).

Conoderus pallipes (Eschscholtz).

Ofu Island, Manua Group, Samoa, 27. ii. 1926, Bishop Museum collection (*A. F. Judd*); Haapai, Tonga, 31. iv. 1925, Bishop Museum collection (*G. P. Wilder*); Tulagi, Solomons, September 1931 (*R. J. A. W. Lever*); Sonata, Russell Island, Solomons, June 1932 (*R. J. A. W. Lever*).

This species has previously been reported from Guadalcanal in the Solomons, and has a wide range throughout the Pacific as far northward as the Marshalls.

Drasterius dorsalis (Say).

A variety of this North American species, referable to *comis* (Le Conte), was recently taken at Nanakuli on Oahu of the Hawaiian group, 16th June, 1935.

Megapenthes madidus Candèze.

The type-locality is Fiji, without more particular designation. In the Bishop Museum collection are three specimens taken by E. H. Bryan, Jr., Colo-i-Suva, Viti Levu, Fiji, 20. vi. 1924.

Melanoxanthus tulagi Van Zwaluwenburg, var.

Malaupaina, Three Sisters Group, Solomons, 10. v. 1934 (*R. A. Lever*), in swallow's stomach (no. 2727). The

specimen lacks the head, but is almost certainly this species, differing from typical specimens only in having the base of the elytra reddish like the pronotum, instead of entirely black.

Pacificola obscura Van Zwaluwenburg.

Teoatea, Hakahetau, Uapou Island, Marquesas, 20th November, 1931, 2000 feet, beaten from *Histiopteris* sp., Pacific Entomological Survey collection. This species has hitherto been known only from the island of Ua Huka, Marquesas.

Anchastus longicornis Candèze.

Kaukau, Guadalcanal, Solomons, 21. viii. 1934, on *Alpinia* leaf (*R. A. Lever*). The specimen, a female, conforms to the description of a male from New Guinea in all particulars except for general body-proportions; these differences I take to be sexual.

Anchastus malaita, sp. n.

Female, 4.7 mm. long.

Eyes black; rest of body yellowish brown with pronotum suffused with fuscous and its anterior margin blackish. Closely clothed with rather coarse, semi-erect, yellowish pubescence with a few scattered, finer, erect hairs on the elytra.

Frontal margin broadly rounded; front convex, closely set with shallow umbilicate punctation. Antennæ slender, feebly serrate, barely exceeding the tips of the hind angles of the prothorax by less than one joint; third joint nearly twice as long as second, second and third together about as long as fourth. Pronotum with shallow umbilicate punctures of various sizes, with fine reticulation between the punctures; the punctures so faint toward the base as almost to disappear. Prothorax slightly wider than long (median measurements), widest at about its basal third, the sides anterior to this point narrowing to the anterior margin, and posteriorly converging slightly to the tips of the hind angles; the posterior angles briefly and sharply uncarinate, the carina at the rear running mediad of the middle of the angle, then curving laterad as it progresses forward. Basal sulci very short and fine. Scutellum flat, elongate, rounded posteriorly;

punctuation sparse. Elytra as wide as prothorax, with the anterior margin rounded to the humeri; sides parallel for about two-thirds their length, thence conjointly narrowed to the rounded apex; striæ rather coarsely shallowly punctate; intervals flat, punctulation comparatively coarse. Propleuræ not sulcate. Mucro sharply up-curved behind the anterior coxæ. First tarsal joint of hind legs definitely longer than the four following together; lamella of third joint elongate; fourth joint very small.

Described from a holotype female, Su'u, Malaita, Solomons, 16. viii. 1934, in jungle (*H. T. Pagden*, no. 3114).

Neodiploconus nigrifrons (Schwarz).

New records: Vella Lavella, Solomons, ix. 1933, three specimens, one at light (*H. T. Pagden*, nos. 248 & 285); Keravat, New Britain, 9. x. 1933, on cocoa-leaf (*J. L. Froggatt*, no. C 594); same locality, 2. ii. 1934, on leaf-tip of *Tephrosia* (*J. L. Froggatt*, no. C 696); Kokopo, Rabaul, New Britain, 18. v. 1934 (*J. L. Froggatt*, no. C 712); Talasea, New Britain, 28. ix. 1934, on flag of rice (*J. L. Froggatt*, no. C 960).

Examination of the New Britain series convinces me that my *N. niger* is a synonym of *nigrifrons*. The type-locality of *niger* (Malaita and Yzabel Islands in the Solomons) should be added to the range of *nigrifrons*, which was originally described from Gardner Island, Bismarck Archipelago.

Melanotus albertisi Candèze.

A specimen, differing from New Guinea examples of this species only by having the punctuation somewhat coarser, was taken at Keravat, Rabaul, New Britain, Bismarck Archipelago, 10. vii. 1934 (*J. L. Froggatt*, no. C 870).

Melanotus guambatæ Van Zwaluwenburg.

Tulagi, Solomons (*R. J. A. W. Lever*). Three specimens, various dates. This species was first described from Guadalcanal.

XXXVII.—Notes on the Natural History of certain Sand-dwelling Cumacea. By G. E. H. FOXON, M.A., F.L.S. (From the Department of Zoology, University of Glasgow, and the Marine Station, Millport.)

INTRODUCTION.

The Cumacea are such a compact and well-defined group that they are usually considered to be of little general interest; but the remarkable differences between the sexes are of considerable biological importance. The observations recorded here were undertaken in an attempt to obtain more exact information as to the habits of these creatures, and to see how far the differences in structure of male and female are reflected in their behaviour. In addition, some previously unobserved facts regarding feeding and breeding have been recorded.

There have been two sources of information—firstly, a large collection of *Pseudocuma longicorne* (Bate) made by Mr. R. Elmhirst, to whom I am greatly indebted, secondly, observations on living specimens carried out both at the Millport Marine Station and in the laboratory at Glasgow.

I have also to thank Dr. W. T. Calman, C.B., F.R.S., for helpful criticism during the course of the work, and several other friends who have helped me to obtain living specimens of various species.

The three species dealt with are *Iphinoë trispinosa* (Goodsir), *Lamprops fasciata* Sars, and *Pseudocuma longicorne* (Bate) (= *P. cercaria* van Beneden).

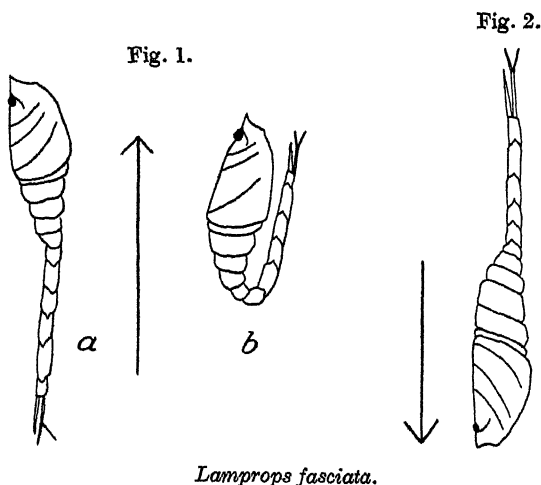
SWIMMING HABITS.

In swimming upwards two attitudes are commonly seen; these are represented in fig. 1, which is of *Lamprops fasciata*.

The attitude shown in fig. 1 *b* is of interest, as the region of the uropods is seen approximated to the mouth-parts. In decapod larvæ the telsonic region with its numerous spines is commonly acknowledged to be used in cleaning the mouth-parts, and it has been suggested (Calman, 1911) that the uropods of Cumaceans and the telson where it occurs, both of which are usually provided

with numerous spines, probably have the same function as the telson of decapod larvæ. As in the Cumacea the telsonic region cannot be brought round to the head while the animal is lying buried in the sand, it is probable that the cleaning of the mouth-parts takes place during swimming. We would thus appear to have confirmation of Dr. Calman's suggestion.

Specimens have been made to swim downwards in response to the stimulus of light; the attitude then adopted is shown in fig. 2. Some individuals of all three species were observed to sink passively in this posture, but a more common sinking attitude is shown in fig. 3.



Lamprops fasciata.

Fig. 1 a & b.—Two attitudes seen when swimming upwards. (Appendages omitted.)

Fig. 2.—Attitude when swimming downwards. (Appendages omitted.)

It is difficult to generalize on the swimming speeds of the Cumacea, but they are of interest, as it is generally supposed that the male is more active than the female. My impression is that the conclusion is justified, but that the swimming powers of the females are by no means negligible.

Cumaceans do not respond to light in the marked manner of decapod larvæ, and they employ various methods of locomotion; for these and other reasons it is not easy to measure their swimming speeds. For

instance, if Cumacea are attracted downwards by a light at first they may not swim to it directly, they may sink and swim down alternately, or they may alternately sink and swim up, but the sum of their movements is a slow downward progression. Once the general downward movement is established, it may not be possible by reversing the direction of light immediately to reverse the direction of movement.

In swimming a Cumacean may swim with its thoracic exopodites or it may be assisted by rapid lateral flexures of the abdomen which greatly increase its speed, but even when swimming with the thoracic exopodites alone the speed of movement is by no means constant. For example, a male *Pseudocuma longicorne* 3 mm. long swam up 10 cm. three times in succession, using,

Fig. 3.



Lamprops fasciata.

Attitude when sinking. (Appendages omitted.)

so far as could be seen, the thoracic exopodites as the sole means of progression; the times taken were 21, 5½, 3½ secs.

If the occasional excessively slow speeds are disregarded we find that at 12° C. males of *P. longicorne* 3 mm. long swim upwards at an average speed of 1 m. in 45 secs., females of just under 3 mm. give an average of 1 m. in 90 secs. As will be explained later, females are slightly shorter than males of the same age. Thus it is seen that the male of *P. longicorne* can, at 12° C., swim approximately twice as fast as the female. This is what was to be assumed from the difference in the number of exopodites

in the male and female; the importance of this in swarming will be discussed in a later section.

The curved position (fig. 1 b) is more often found adopted by females than by males; it does not appear to influence their speed to any appreciable extent.

From further observations on *Lamprops fasciata* it would appear that not only do the swimming and sinking rates of different species vary, but that considerable variation exists in the speeds attained by any one individual during the different stages of its life-history. For example, an ovigerous female will swim more slowly than a female which is not ovigerous, but will sink more rapidly. The female which is not ovigerous will sink at a speed comparable with that of a male of the same size, but owing to the male's greater swimming powers it will swim much faster than the female. Thus when making comparisons between species it is necessary to compare males with males and ovigerous females with ovigerous females, and so on.

Dealing with ovigerous females it is seen that both those of *Pseudocuma longicorne* and of *Lamprops fasciata* take 90–100 secs. to swim up 1 m. at 12° C., the figure falling to 65–75 secs. at 20° C.; thus the swimming powers of the ovigerous females in these two species show considerable similarity. Females of *P. longicorne* are, however, only about half the length of those of *L. fasciata*, which attain a length of 7 mm.; this difference is reflected in the sinking rates. Ovigerous females of *P. longicorne* were, at 20° C., found to sink at the rate of 1 m. in 70 secs., those of *L. fasciata* at 1 m. in 38 secs.

As an example of differences between ovigerous and non-ovigerous females we may take the case of *L. fasciata*, where at 12° C. an ovigerous female sank at the rate of 1 m. in 40 secs. and a non-ovigerous female at the rate of 1 m. in 55 secs.

The above figures, which were obtained in the same way as those for decapod larvæ (Foxon, 1934), are averages from a number large enough to eliminate the more gross errors, and give some idea of the speeds at which these creatures may move in the sea.

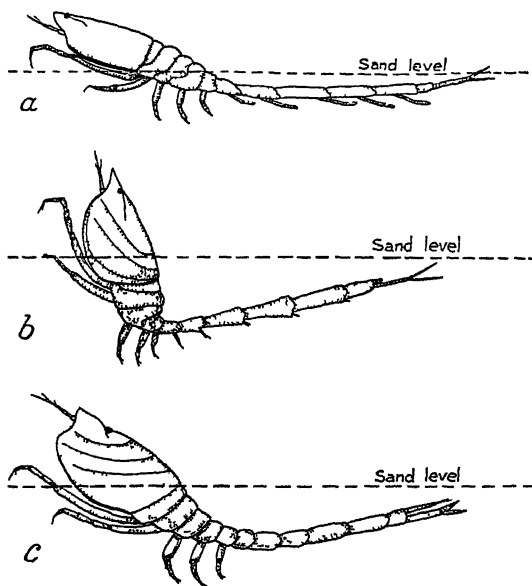
FEEDING HABITS.

The feeding habits have recently been described both by Dennell (1934) and by Zimmer (1932).

Dennell described in detail the filter-feeding mechanism of *Diastylis bradyi*, and Zimmer also described *D. rathkei* as feeding on minute particles in suspension.

Zimmer also observed the feeding habits of several sand-dwelling species, including *Iphinoë trispinosa*, *Lamprops fasciata*, and *Pseudocuma* sp. I have made observations on the same species, and my observations agree with those of Zimmer in practically all respects, but

Fig. 4.



Attitudes of (a) *Iphinoë trispinosa*, (b) *Pseudocuma longicorne*, (c) *Lamprops fasciata*, when buried in the sand. (Thoracic exopodites omitted; not to same scale.)

on one or two points I am able slightly to amplify his account. The *Pseudocuma* I observed was *P. longicorne*.

Feeding takes place when the creatures are half buried in the sand, and the attitudes adopted are not the same in all species. Three of the attitudes are illustrated in fig. 4, and Zimmer has illustrated the attitude of *Lamprops fasciata* and compared it with that of *Diastylis* sp.

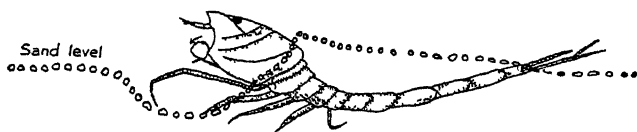
Specimens of all three species were seen to bury themselves in the sand by the activities of the three more backwardly turned posterior pereopods. The posterior part of the thorax and the anterior portion of the abdomen are buried first; then the uropods are buried by their own activities.

Zimmer has dwelt at some length on the actions of these burying pereopods, and has shown how they are structurally adapted to their function.

The slender specimens of *Iphinoë trispinosa* were found to conceal themselves very completely, but the more rotund *Pseudocuma longicorne* holds the thorax and abdomen nearly at right angles to one another, and is more conspicuous.

In feeding the first pereopods are extended forwards and collect grains of sand; this process has been recorded

Fig. 5.

*Lamprops fasciata.*

Attitude when feeding. (Thoracic exopodites omitted.)

by Zimmer. The sand-grains may be of considerable size as compared with the animal; they are swept in by the first pereopods, so that they can be grasped by the mouth-parts; Zimmer has pointed out the important part played by the second maxillipeds. The mouth-parts then rotate the sand-grain as indicated in fig. 5. Presumably organic matter is scraped off the sand-grains, of which some appear to be more tasty than others and are retained in the mouth-parts for a longer time.

When the grain of sand is finished with it is tossed upwards over the eye, and usually falls on to the carapace, whence it rolls off to one side. Thus the animal becomes more and more completely buried, but in front the excavation made by the removal of the sand-grains by the first pereopods remains. As soon as one grain is finished with the process is repeated with another.

Finally, when the creature is well buried it generally leaves that spot and swims away to a fresh site, where it settles down and begins to bury itself again.

In *Lamprops fasciata* the sand-grain is thrown upwards into the exhalent respiratory current, and may be carried a short distance before it falls; but in both *Pseudocuma longicorne* and *Iphinoë trispinosa* the exhalent current is much less conspicuous.

So far as could be seen, practically the whole time in these three species was spent in revolving sand-grains, and only occasionally did individuals remain at rest. It would appear that filter feeding is of minor importance in sand-dwelling species. This is perhaps to be expected, as organic particles in suspension will be less numerous in sandy than in muddy localities. That the essential elements of a filter-feeding apparatus are present can be seen both from an examination of the mouth-parts and from an inspection of the various figures of the mouth-parts given by Sars and others. Possibly it may be of use in capturing organic particles dislodged from the sand-grains. Zimmer apparently did not meet with filter-feeding in sand-living forms.

THE FORMATION AND COMPOSITION OF SWARMS.

The difference in the behaviour of male and female Cumaceans is well recognized. In particular, it is known that swarms which form at the surface at night often consist entirely of males. As has been shown above, this latter point may be correlated with the difference in the swimming organs and powers in the two sexes.

But while such generalizations as "the males at night make excursions to the plankton while the females remain behind on the bottom" convey a certain amount of truth it is not clear that they are of universal application. Many hauls of *Nannastacus* spp. are composed entirely of males, but in shallow-water species some females usually occur.

Dealing with *Pseudocuma longicorne*, the following are some counts made from Mr. Elmhirst's collections:—

Date.	Time.	Males.	Females.
23. ii. 32.	5 A.M.	519	396
1. iii. 32.	Midnight.	93	103
2. iii. 32.	3 A.M.	166	149

These hauls were taken at the water's edge, where it was just deep enough to draw a tow-net when wading ; none shows a great predominance of males over females. Further collections made in the same way during the night 29th to 30th July, 1932, give the same conclusion ; but collections made in slightly deeper water show greater variation in numbers.

A haul of *P. longicorne* made at midnight on 21st June, 1932, was composed of 132 males and only 15 females. On the other hand, a collection of *Iphinoe trispinosa* made at 2 fathoms at midnight on the night 29th to 30th July, 1932, was made up of 13 males and 14 females.

Here we are dealing with shallow-water species, and the difference in the swimming powers of the two sexes is not very apparent in coming to the surface from such a small depth ; but I believe that the evidence does point to the females taking part in the swarms, although they are not so conspicuous. The reasons for the presence of the swarms are fairly obvious, for it is unlikely that the formation of pairs would take place in the sand, and probably one of the more important functions of the swarm is to enable the males and females to locate each other. If this be so, it is possible that in those cases where swarms consisting entirely of males are found these are forming a swarm into which the females can swim and so find a mate—much as has been described for certain mosquitoes by Lewis (1932). He records that in certain species the behaviour of the two sexes is remarkably different ; the females fly near the ground, while the males swarm higher in the air, and the swarming of the males is thought to help the females to find them.

There is an interesting point connected with the habits of Cumaceans in captivity. When decapod and euphausiid larvæ swim to the surface of a vessel in response to a light stimulus, on reaching the surface they still continue their swimming activities and are liable to be caught in the surface film. The behaviour of Cumaceans is in marked contrast to this : on reaching the surface they immediately cease swimming and sink for a short distance, as far as 10 cm., usually in the attitude shown in fig. 3 ; then they swim up to the surface again and repeat the sinking many times over. In

captivity they often touch each other while doing this, and then they attempt to form pairs; it may be that this is the way that pairs are formed in the sea. Occasionally pairs consisting of two males have been met with, but it is likely that on most occasions one male would succeed in escaping from another, whereas a female would be less active and less ready to escape. Whether the males have any means of recognizing females on or before touch is not known, but it is possible that the second antennæ may have some sensory function.

It may be noted that, as the males swim more quickly than the females, if an external stimulus acting on both of them simultaneously were responsible for making them seek the surface waters, the females on arrival at the surface would find the swarms of males already assembled. Then on arrival at the surface the more active males are able to overtake and capture them.

The collections at my disposal were all made in shallow water, and those taken at the water's edge contain many immature specimens; but sand samples were found to contain smaller specimens still. It may be that young Cumaceans do not join in the swarms until the period of sexual maturity is approached. It would also seem likely that the females come to the surface when eggs are about to hatch, so that the young may have the same opportunity for dispersal.

THE DEVELOPMENT OF THE SEXUAL CHARACTERS IN *PSEUDOCUMA LONGICORNE*.

The smallest specimens of this species in the collections measured 1.5 mm. in length; at this stage it is difficult, if not impossible, to tell the difference between the two sexes. On the whole, the males tend to be slightly longer than females of the same age. Where the majority of females ranged from 2 to 2.5 mm. the males had a range of 2.5 to 3 mm.

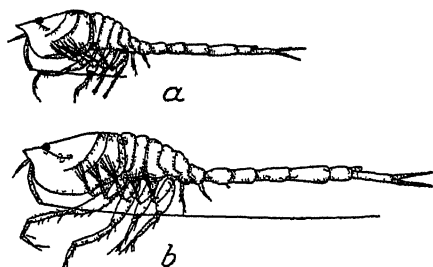
Stebbing (1913) gives a considerable list of characters in which the two sexes of this species are said to differ, but in going over the present collections one soon became accustomed to picking out the males from the females by their different configuration, the males being distinctly more slender and less rotund than the females.

The males do not attain the so-called "fully adult" stage suddenly in one moult, but develop their distinctive characters gradually. It is usually possible to separate the sexes at 2 mm.

The so-called "fully adult" male of Sars is shown in fig. 6 *b*. It will be noticed that the second antenna reaches almost as far as the end of the pleon. There are two pairs of pleopods, the second pair not very well developed, and the first four pereopods bear exopods. An apparently earlier stage is shown in fig. 6 *a*.

A specimen of 2.75 mm. was found to have the second antenna reaching three-quarters of the way along the

Fig. 6.



4 mm

Males of *Pseudocuma longicorne* : *a*, sexually mature stage with short antennæ ; *b*, fully adult stage of Sars.

pereon ; one pair of pleopods was showing, but not fully developed, and the setæ of the exopodites of the fourth pereopod were short.

By the time that 3 mm. is reached the second antennæ extend to the end of the pereon ; one pair of pleopods is fully developed and the thoracic exopodites are complete. The full length of the antenna is only found in males approaching 4 mm.

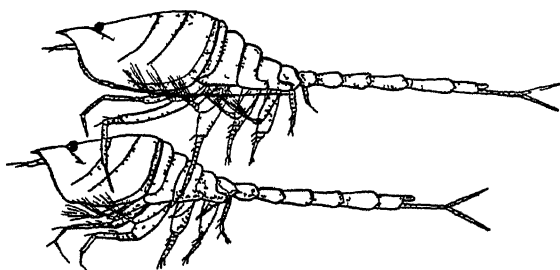
Two points of interest were noted in the collections : firstly, there were remarkably few "fully adult" males, and, secondly, that the females carrying eggs were between 2.5 and 3 mm. at a time when the males in the same hauls were 3 to 3.5 mm. in length—that is, far from being "fully adult."

This naturally gave rise to the thought that the males might be sexually mature before the "fully adult" form was attained—that is, when they are only 3 mm. in length and the second antennæ only extend as far as the end of the pereion.

Fortunately during a visit to Millport several males were found carrying the females, and all the males were of the 3 mm. stage. One pair was fixed, and has been used to fill in the details of fig. 7, the general attitude having been sketched from life.

Contrary to expectation the second antennæ, which are of a suitable length to serve as claspers, do not fulfil this function. The antennæ of *Lamprops* spp. are used as claspers (Sars, 1900, p. 5). It may be that the

Fig 7.



Pseudocuma longicorne, male (with short antennæ)
and female paired together.

antennæ in some way assist the males to detect the females, for a male and female which were accidentally separated in a watch-glass containing water and sand became reunited in a remarkably short time. Those which meet in the water remain paired in the sand, and I think that the normal method of feeding by revolving grains of sand is still carried on.

The male holds the female with the first and second pereopods; the maxillipeds rest on the carapace of the female, and often may be seen to move quickly, as if tapping on or scratching it, perhaps something in the nature of a caress.

Gilson (1906) was of the opinion that these males with short antennæ were a special variety of male

and not a stage in the development of the "fully adult" male of Sars. He found that those with short antennæ had a similar spinulation of the uropods to that found in the females, quite different from that of the males with long antennæ. Gilson also found variations in the terminal joints of the second pereopod. He records also some which displayed the characters of the fully adult male and which could be differentiated from those with short antennæ of the same size.

I am not convinced that Gilson was correct in deciding that there were two distinct varieties of males. In my collections, although there were plenty of males with long antennæ, I have not been able to find any young examples of this form as Gilson did—that is, none of the young males showed the spinulation of the uropods as in Gilson's fig. 10. Also it is peculiar that he does not mention the pleopods. I found that all the males with short antennæ had only one pair of pleopods developed and those with long antennæ two pairs of pleopods. My specimens agree with Gilson's (see his fig. 1) both in having the second antennæ longer than described by Sars and in the spinulation of the uropods.

I prefer to say not that there are two varieties of male, but that the form of the male is highly variable.

If we consider the points in which they differ conspicuously from the females, namely, the length of the second antennæ, the structure of the terminal joint of the second pereopods, the arrangement of the spines on the uropods, and the length of the telson, we find that in the different forms of males that have been described these characters are developed in varying degrees.

I. *The Male Type of Sars*.—The antennæ are shorter than in Gilson's males "with long antennæ" and my specimens of this kind; the second pereopod is female in facies, having no hook on the terminal joint; the spinulation of the uropods is distinctly male.

II. *Males with Long Antennæ of Gilson's Type*.—The antennæ are longer than those of Sars's type; the second pereopods are of another or male type (having three hooks); the spinulation of the uropods is male.

III. *Males with Short Antennæ*.—The second antennæ are shorter than in Sars's type; the second pereopod belongs to a third type which has one hook; this is there-

fore an intermediate type. The spines on the uropod are arranged as in the females. There is only one pair of pleopods developed. Although the telson is definitely of a male facies it is slightly shorter in proportion to the length of the animal than it is in the males with long antennæ. Thus in certain respects the males with short antennæ resemble the females. The most extreme form is the long antenna type of Gilson, then comes Sars's type with its slightly shorter antennæ and the pereopods of the female facies, finally males with short antennæ, the intermediate type of second pereopod, and uropods with the spinulation of the female.

If we imagine that the female form is a state to which male characters may be added during the development of the male we can see that various factors, whether internal or external, may result in the production or non-production of the various male characters and their production in differing combinations and different degrees. Such a picture has room for all the types at present described. The sexual maturity of the males with short antennæ, their short length, and their single pair of pleopods does, however, point to some speeding up of development.

NOTES ON BREEDING.

It is most convenient to start an account of the yearly sequence of events in the Cumacea with a survey of the winter stock. This is produced during September and October, and in October and November the adults are dying off. *Pseudocuma longicorne* may be slightly later in producing its winter stock than *Iphinoë trispinosa*, at least at Millport, for on September 30th, 1934, a few older *P. longicorne* were still to be found, but only very young *I. trispinosa*. Indeed, at this time several males of *P. longicorne* were to be found carrying females, but it is doubtful whether such late breeding is completed.

The winter stock appears to persist without growing very much until the following February. On February 23rd, 1932, Mr. Elmhirst made a collection of *P. longicorne*; there were 519 males and 396 females. Only one of the males was of the fully adult variety, and it would

appear rare for such to survive the winter; the remainder were between 2 and 3 mm., with the second antenna one-fifth to one-fourth the length of the body. The females were on the whole slightly shorter than the males, being 2 to 2.5 mm.; a few of 2.5 mm. were ovigerous.

Collections made on the night of 1st to 2nd March, 1932, showed that both sexes had increased in size; some males were 4 mm. long and the females 3 mm. and ovigerous.

In February, 1935, some *P. longicorne* were kept for a few days under observation in the laboratory. The males were 3 mm. long and the females slightly less; no ovigerous females were seen, but dissection showed that the ovaries contained numerous developing eggs. Several specimens attempted to moult, a proceeding which in captivity appears to be rarely accomplished successfully. Some of the males were seen trying to pair with the females; thus it appears that in the Clyde area breeding begins in the first two weeks of February.

How long it takes for the eggs to hatch has not been discovered. In a collection made on June 21st, 1932, it was easy to separate two distinct groups, one of larger specimens, the males being between 3 and 4 mm. and the females mostly ovigerous, and a second group of very young specimens the sex of which was difficult to determine. These latter specimens ranged from 1.5 to 2.25 mm. long; they might have been the offspring of the winter stock, but it is more probable that at least one generation had intervened; and as the females would all have died on liberation of the brood, it is a very difficult point to check. On the other hand, broods do not appear with clockwork regularity, and by the time that the end of the season is reached in October it is impossible to sort out distinct generations. The males range from 1.5 to 4 mm. in length. The smaller specimens (1.5 to 1.75 mm.) are more common in the sand than in the water, and are obviously the winter stock.

MOULTING.

Several moulted skins of *Pseudocuma longicorne* have been met with. The skin is sometimes seen to be cast complete, the only break visible being a dorsal

longitudinal slit in the posterior half of the thorax; in males even the slender exoskeleton of the long second antennæ remains in place. At other times the skin is cast in two or more pieces, but still the covering of the abdomen and last three thoracic segments comes away in one piece (one case of this being met with in *Iphinoë trispinosa*).

THE COLLECTING OF CUMACEA.

Cumacea are usually obtained by means of a tow-net at night, and collections made in this way throw much light on their migrations; but it seems likely that more information on other points in their natural history could be obtained by the adoption of other methods.

The difference in feeding habits between sand-dwelling and mud-inhabiting Cumaceans is now well established, and there is reason to suspect that different sand-dwelling species favour sands with distinct qualities, both as regards the physical and chemical characters of the sand itself and also such general environmental factors as depth. So far no opportunity of working out any such relations between the animals and their environment has presented itself. Meanwhile one can suggest that when possible collections made by the usual tow-net method should be supplemented by the means I have adopted:—some sand is collected in a bucket either on the shore or from a boat, according to the species required or the locality being investigated, and left standing with about 2 inches of water over its surface; the bucket is then gently agitated, so as to throw some of the sand into suspension, and the water poured off, when, if Cumaceans are present some will be found in the decanted water. Clear water is now added to make up for that poured off, and after 30 minutes or longer the process is repeated. Living Cumacea can be obtained in this way up to twenty-four hours after the collection of the sand.

This method of collection also has the advantage that it can be made during the daytime and the perfect conditions necessary to produce a swarm need not be awaited; if Cumaceans are present in the locality at all some are practically sure to be found in each sample. Collections are best made during calm weather, as when

rough the sand in shallow water tends to be disturbed and the Cumaceans bury themselves deeply.

SUMMARY.

Three species of Cumacea have been observed, namely, *Pseudocuma longicorne*, *Iphinoë trispinosa*, and *Lamprops fasciata*.

The swimming and sinking habits of these three species have been described, and swimming speeds of males and females have been measured. At 12° C. males of *P. longicorne* swim twice as fast as the females. This is correlated with a difference in the development of the swimming appendages of the two sexes. It is thought that the uropods may be used to clean the mouth-parts while swimming.

The difficulty of comparing the swimming powers of different species is pointed out.

The main purpose of swarming is to enable the male and female to find each other, which would be impossible in the sand. Having found each other they probably return together to the sand and remain paired for some time.

In *P. longicorne* three varieties of male have been described; a scheme to include them all is suggested.

Breeding in *P. longicorne* begins in February and continues until October; the number of broods is not known; the winter stock is produced in September and October.

The skin of Cumaceans is moulted in one or more pieces; if in one piece even the delicate skin of the second antenna of the male remains in place.

It is suggested that much may be learned of the habits of Cumacea by collecting them on their feeding grounds as well as when they are swarming.

LIST OF REFERENCES.

- CALMAN, W. T. 1911. 'The Life of Crustacea.' London.
 DENNELL, R. 1934. "The Feeding Mechanism of the Cumacean Crustacean *Diastylis bradyi*." Trans. Roy. Soc. Edinb. lviii. pp. 125-142, text-figs. 1-9.
 FOXON, G. E. H. 1934. "Notes on the Swimming Methods and Habits of certain Crustacean Larvæ." J. Mar. Biol. Ass. U. K., n. s. xix. pp. 829-849, text-figs. 1-7.
 GILSON, G. 1906. "Recherches sur les deux *Pseudocuma* de la Mer Flamande. *P. longicornis* Spence Bate et *P. similis* G. O. Sars." Mém. Soc. Ent. Belgique, xii. pp. 77-96.

- LEWIS, D. J. 1932. "The Mosquitoes of Wicken Fen." In the 'Natural History of Wicken Fen,' ed. J. S. Gardiner, pt. vi. pp. 548-559.
- SARS, G. O. 1900. 'An account of the Crustacea of Norway.—III. Cumacea.'
- STEBBING, T. R. R. 1913. "Cumacea" in 'Das Tierreich,' ed. F. E. Schulze, pt. 39.
- ZIMMER, C. 1933. "Beobachtungen an lebenden Mysidaceen und Cumaceen." S.B. Ges. naturf. Fr. Berl. 1933.

XXXVIII.—*Undescribed Mossmites from Mauritius.* By ARTHUR PAUL JACOT, Appalachian Forest Experiment Station, Asheville, N. Car.

THE following species of Oribatid mites have been sent to me for determination and description by Dr. Reginald Frederick Lawrence, formerly of the South African Museum. All of them are new. The most nearly allied described fauna is that of the Seychelles (9). Types are being deposited in the British Museum. The material was collected by Dr. Lawrence with the co-operation of Mr. Jean Vinson, entomologist at Mauritius.

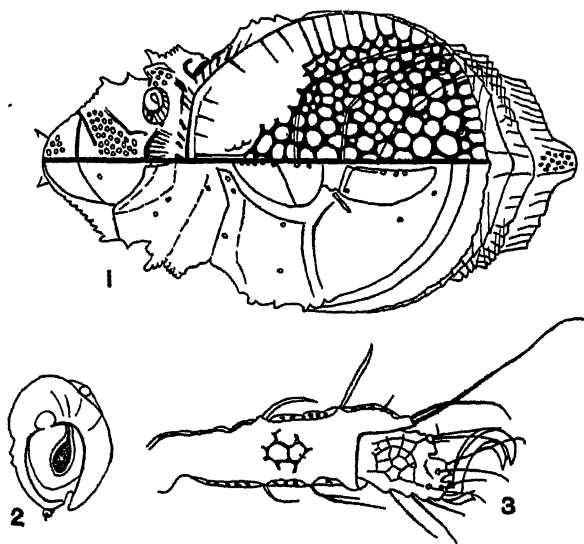
Udetaliodes mauritius, sp. n.
(Figs. 1-3.)

Diagnostic characters.—Depressed; retained notogastral skins projecting conspicuously as a pygidial veil (fig. 1); cephalon pitted; notogaster coarsely and irregularly areolated, without bristles; pseudostigmatic organs clavate, included by pseudostigmata (fig. 2).

Description.—Size 0.8 to 0.94 mm. long and 0.53 to 0.6 mm. broad; cephaloprothorax compact; rostrum broad, not distinct, dorsal face pitted, rostral bristles distinct, fine, strongly curved ventroposteriad; pseudostigmata (fig. 2) oval, anteromesal edge with excised circle, lateral edge with vertical slot, base incorporating interlamellar bristle insertion (bristle not discernible); exopseudostigmatic bristle at base of pseudostigmata; interpseudostigmatic area raised in a series of low divaricating ridges which are spanned by a crescentic ridge; area laterad of pseudostigmata pitted; tectopodia ii. poorly developed; posterior edge of prothorax with short divaricating ridges.

Notogaster without discernible bristles, anterior area fairly smooth, median plane relieved by a pair of parallel ridges flanked by an incomplete, scalloped ridge, remainder of notogaster sculptured in quite irregular areolations, which are chiefly coarse but sprinkled with much smaller; radiating ridges of lateral edge more restricted than usual for the genus, the retained skins quite tenacious, quite hyaline.

Ventral plate not unusual; parasterna iii. with lateral and middle bristles widely spaced, middle and mesal



Udetaliodes mauritius, sp. n.

Fig. 1.—Dorso-ventral aspects, legs and mouth-parts omitted; $\times 75$.

Fig. 2.—Pseudostigma with organ, interlamellar bristle, and exopseudostigmatic bristle; $\times 440$.

Fig. 3.—Tarsus and tibia i.; $\times 150$.

bristles close; genital cover sculpturing comprised of small areolations; paranal pseudofissuræ long; anal cover bristles closely spaced; paranal bristles more posterior than usual.

Legs quite long and slender; all segments areolated; ungues green (in balsam mounts). Tarsi i. (fig. 3) with ventrodistal bristles broadening distad, truncate at distal

end (fig. 3); dorsal quartette comprised of two normal subequal bristles and two very fine short bristles: one erect, one porect; tibiæ i. with dorsal tubercle highly developed, far overhanging tarsus, tactile bristle very long (fig. 3), dorsal face with an erect fairly long spine inserted slightly posteriad of base of dorsal process, a decurved spine inserted over centre of body of segment, and a short bristle inserted over centre of dorsal process; ventral face with three depressed bristles.

Probably related to *Neoliodes capensis* (2, p. 266).

Material examined.—Three specimens shaken from tree branches, indigenous forest, Les Mares; taken December 30th, 1934, microslide no. 35M16. Four specimens shaken from tree branches, indigenous forest, Le Ponce, alt. 2400 ft.; taken January 5th, 1935, slide 35M18. Five specimens shaken from tree branches, indigenous forest, Curepipe; taken January 12th, 1935, slide 35M17-2. All are cotypes, the figures being based on material from slides 35M16 and 35M17-2.

Genus LAWRENCOPPIA, gen. nov.

Oppioid but of massive build; notogaster with twenty-eight bristles; sculptured; genital and anal apertures separated by less than length of genital aperture; legs iii. attached to cephaloprothorax, parasterna iii. closely joined to parasterna ii.; greatest constriction of thorax thus occurring between legs iii. and iv.; tectopodia ii. not developed laterad of insertion of legs i.; apodemata free at lateral ends so as to expose ventral face of coxæ i. and ii.; legs massive, nothrine, unguis stout, monohamate.

Type: *Lawrencoppia mauritius*, sp. n.

Lawrencoppia mauritius, sp. n.

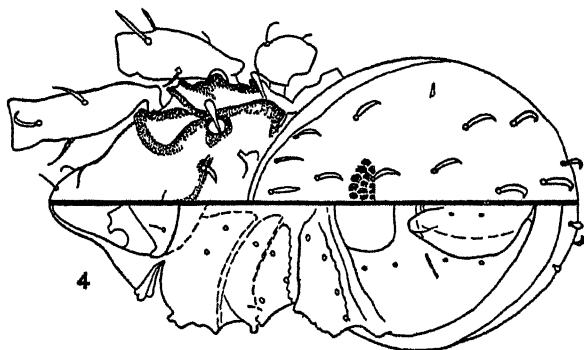
(Fig. 4.)

Diagnostic characters.—Pseudostigmata short, clavate; interlamellar bristles and notogastral bristles lanceolate, curved; notogaster sculptured; prothorax with a sclerotized band joining interlamellar bristles and sending a slender tongue anteriorly on median line.

Description.—Size 0.6 × 0.32 mm.; cephaloprothorax nearly as large as notogaster, constricted near base

of rostrum; rostrum stout; rostral bristles rather short, stiff, divergent, inserted fairly near median plane; cephalon sculptured with very fine combing; prothorax very finely stippled; lamellar bristles rather short, curved, inserted near base of rostrum, at foot of a slight declivity, which is indicated in fig. 4 by a short line; sides of cephaloprothorax with sclerotized bands as in fig. 4, a short band on posterior edge behind interlamellar bristles; pseudostigmata fairly large, quite open.

Notogaster subcircular, exposing lateral end of parasterna iv. sculptured with low, irregular, polygonal rugosities, separated by fine impressed lines forming



Laurencoppia mauritius, gen. et sp. n.

Dorso-ventral aspects, legs and mouth-parts omitted; $\times 120$.

a fine network; the two posterior bristles not visible in dorsal aspect. Ventral plate sculptured with fine combing and wave-ripple pattern; not encroached on by notogaster, slenderly continuous behind anal aperture; anal aperture large; anal covers with two bristles inserted near median edge, a longitudinal rib or suture laterad of centre; genital aperture half length of anal aperture, broader than long; cover bristles not discernible in holotype; two pairs of bristles at sides of anal aperture; two pairs at side of genital aperture; parasterna ii. each with four bristles, the mesal one near anterior edge, the others close to posterior edge; para-

sterna iii. each with three bristles, the middle one on posterior edge, the others near anterior edge; parasterna ii. with the single bristle distant from mesal end; parasterna i. with the two bristles posteriad of camero-stome but midway between anterior and posterior edges of plate; tectopodia if present represented by small nubbins.

Legs armed with stout bristles, some of them clavate, some acicular; segments sculptured with fine combing and wave-ripple pattern; tibiae i. with well-developed dorsodistal process bearing a long tactile bristle.

Holotype: shaken from tree branch, indigenous forest, Curepipe; taken January 12th, 1935, slide 35M17-4.

The genus is named after its collector so that the *c* is soft.

I regard this species as belonging to the primitive Oppian stock. It does not seem to have developed modern types (with legs iii. inserted so far forward).

Genus *DRYMOBATOIDES*, gen. nov.

As *Drymobates* (3, p. 267) of the tribe Scheloribatini, but rostrum not compressed and prominent; no median furrow along cephaloprothorax; notogaster without definite porose areas but (irregularly) peppered with pseudoforamina; ungual hooks not serrate on dorsal edge; apex of side hooks deeply cleft; femora i. without marked flange.

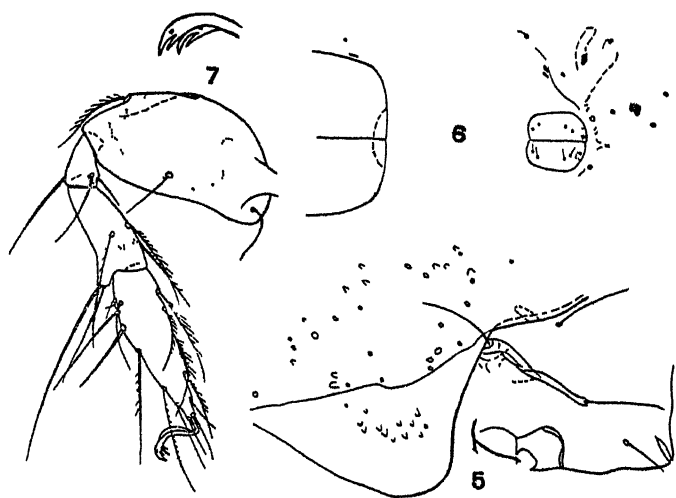
Type: *Drymobatoides mauritius*, sp. n.

Drymobatoides mauritius, sp. n.
(Figs. 5-7.)

Diagnostic characters.—Pseudostigmatic organs a fine bristle subequal to lamellar and interlamellar bristles (fig. 5); notogaster without bristles; exopseudostigmatic bristles apparently absent; genital cover bristles 1 and 2 close to each other, widely spaced from 3 and 4, which are also closely spaced (fig. 6); no paramesal bristles; paranal bristles on transverse plane slightly posterior to very short pseudoforamina.

Description.—Size large (toto measurements not securable, genital aperture; 0.131 mm. long, 0.139 mm. broad); lamellæ rather slender in lateral aspect (fig. 5); rostral

bristles quite fine; tectopedia i. and ii. not developed (fig. 5); pteromorphæ well developed; genital aperture quite small, sides nearly parallel, with a short sclerotized bar under anterior edge (fig. 6); attached area of apodemata i. and iv. very short, ii.-iii. long, slender; parasterna thinly sclerotized as compared to abdominal part of ventral plate; ventral plate bristles short and fine; posterior sternal bristles on edge of frame of genital aperture; anal aperture large, sides somewhat parallel, pseudofissuræ short, near anterior corners of aperture;



Drymobatooides mauritius, gen. et sp. n.

Fig. 5.—Anterolateral aspect of cephaloprothorax; $\times 60$.

Fig. 6.—Gonital area and anterior end of anal aperture; $\times 60$.

Fig. 7.—Legs i., $\times 120$; and hooks of same (above numeral), $\times 440$.

paranal bristles slightly posteriad of pseudofissuræ; other characters not discernible in holotype.

Legs with short shafted ungues, each bearing three hooks, distal end of side hooks deeply cleft and with a tiny "hole" dorsad of proximal end of slit (see figs. above numeral 7). Tarsi i. (fig. 7) with three of the dorsoproximal quartette of bristle insertions in a nearly straight row and touching each other, proximal insertion bearing a minute fine bristle inclined distad, middle insertion with a shorter erect bristle, distal insertion

bearing a normal fairly long bristle; bristle 5 simple, rather stout; bristle 6 with five cilia; ventrodiscal bristles simple, nearly straight; ventral face bristles rather long, with upturned tips (fig. 7), the proximal bristle with about thirteen rather long cilia, bristles 2 and 3 with about nine cilia, bristle 4 with about five. Tibiæ i. rather short, with well-developed dorsoproximal nubbin which is truncate; bristles normally developed. Other segments and their bristles normally developed (fig. 7).

Holotype: shaken from tree branch, indigenous forest, Curepipe; taken January 12th, 1935, slide 35M17-3.

Genus SPHÆROBATES (8, p. 11).

Species of Scheloribatini with very broad abdomen; pteromorphæ sloping rapidly backward and only sloping ventrad; lamellæ slender, with short cusp which is concave on median edge; translamella well developed; tectopodia i. slender, extending to insertion of rostral bristles; midthoracic suture lacking mesad of interlamellar bristles, leaving middle portion of anterior edge of notogaster fused to prothorax; notogaster without bristles; hooks of unguis triheterohamate, with normal distal end.

Type: *Sphærozetes* (?) *gratus* (6, p. 72, fig. 1; 8, p. 11, fig. 15).

In the original description the midthoracic suture is figured as strong and complete. In 1927 (fig. 15) it is shown as indistinct in middle. A Javanese species (10) has this suture lacking in middle. The unguis of these two species are described without reference to modified distal end, but the central hook is recorded as slightly stouter than the lateral. Judging from a specimen from North Carolina (U.S.A.), which seems to be identical with *Sphærobates gratus*, the midthoracic suture is entirely lacking between the interlamellar bristles; the hooks are without accessory tooth (or notch); the translamella is quite broad, and the pteromorphæ are not strongly curved ventrad.

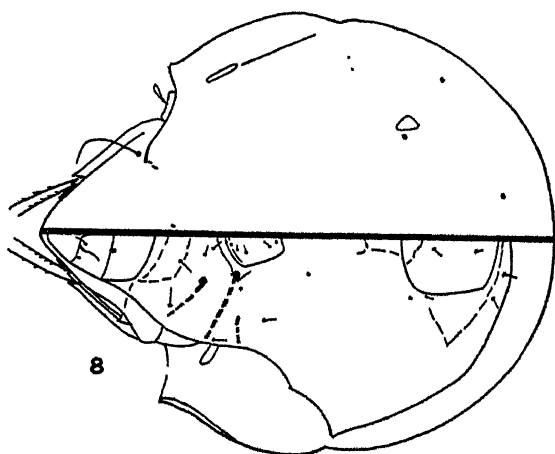
Oribates sphærula (1, p. 171, pl. xvii. fig. 42) has specialized claws and no midthoracic suture whatever. In 1925 (7, p. 473) Sellnick suggested using the term *Unguizetes* for this species and two undescribed Brazilian species. As he did not bring out this name in the

standard form, followed by gen. nov., and as he designated no type it was overlooked by Jacot, who in 1929 (4, p. 429) made this species type of the genus *Terrazetes*. *Mochlozetes* (3), a new world genus, is closely related but distinct. *Terrazetes* may be retained as a distinct genus characterized as follows :

Genus TERRAZETES (4, p. 429).

Species with very broad abdomen ; lamellæ slender, with short cusp ; translamella weakly developed ; midthoracic suture lacking mesad of interlamellar bristles ; pteromorphæ well developed, both anteriad and ventrad, being strongly curved ventrad ; lateral hooks of unguis with accessory tooth near distal end (a subapical notch) ; notogaster without bristles.

Type : *Euzetes* (?) *sphærula* (7, p. 470, figs. 18-21).



Terrazetes mauritius, sp. n.

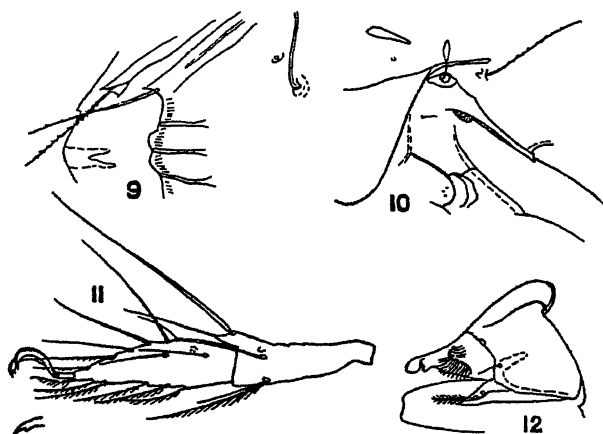
Dorso-ventral aspects, legs and mouth-parts omitted ; $\times 75$.

Terrazetes mauritius, sp. n.
(Figs. 8-12.)

Diagnostic characters.—Distal end of tectopodia i. produced as slender ridge anteriad of rostral bristles (fig. 8) ; rostral bristles pauciciliate ; lamellar bristles

with about three widely spaced cilia (fig. 8); interlamellar bristles burred; pseudostigmatic organs clavate, quite short, not extending to lateral edge of pteromorphæ as seen in dorsal aspect; a slight translamella (figs. 9 & 10); centre of vertex with three slender ridges (fig. 9) not visible in most dorsal aspects; adalar, lateral-mesonotal, and posterior porose areas long and slender; ventral plate bristles short; lateral postanal bristles not behind anal aperture; attachment area of apodemata i. quite short (fig. 8).

Description.—Closely resembling *Sphærobates javensis* but lamellæ and translamella less developed, more slender; size 0.92 to 1.04 mm. long by 0.73 to 0.85 mm. broad;



Terrazetes mauritius, sp. n.

Fig. 9.—Rostral pseudofenestration and translamella to mid-thoracic suture; $\times 100$.

Fig. 10.—Adalar porose area to tectopedium i.; $\times 75$.

Fig. 11.—Tarsus and tibia i.; $\times 150$.

Fig. 12.—Maxillæcoxa, maxilla, and ligula; $\times 200$.

anal cover bristles closer to median edge; a shallow groove behind anal aperture swings antero-laterad of the aperture (fig. 8); paramesal insertions small, less than length of a genital cover from genital aperture; acropleural porose areas close to lamellæ, slender (fig. 10); maxillæcoxæ quite distinct (fig. 12), anterior bristle rather short and fine, lateral bristle long, springing from

proximal edge of plate; maxillæ with a comb of bristles on inner face, recalling the lacinia in beetles (fig. 12); bristles of ligula bilaterally ciliate; palps five segmented.

Legs with long-shafted ungues, each bearing three hooks, distal end of side hooks with short cusp. Tarsi i. (fig. 11) with three of the dorso-proximal quartette of bristle insertions in a nearly straight row and touching each other, proximal insertion bearing a fine bristle crossing the anterior, middle bristle not developed or not distinguishable; dorsoproximal bristles ciliate; ventro-distal bristles curved with about eight long cilia (fig. 11); ventral face bristles with about eight cilia. Tibiæ i. with well-developed peduncle and dorsodistal nubbin, which is pointed; major ventral face bristle with about fifteen cilia.

Cotypes: twenty-three specimens from under bark of Eucalyptus (?), Botanic Gardens, Curepipe; taken January 2nd, 1935, slides 35M19-1 and -2. Figures derived from both slides.

This may well be an introduced species.

Humero Bates humeralis mauritius, subsp. n.

As the species (5), but rostral bristles conspicuously closely ciliate; a distinct translamellar line (which may indicate a very steep vertex at this point); adalar porose areas quite large; a distinct pseudoforamen laterad of anterior mesonotic porose areas as well as one posteriad; sternal bristles stiff, stout, gular pair quite remote, posterior pair much more remote than middle pair, which are just laterad of edge of somewhat indefinite sternum. Other characters indistinct in the one (ovigerous) specimen before me. Size 0.76 mm. long, 0.55 mm. broad; thus about the size of European specimens but broader.

Holotype: shaken from tree branch, indigenous forest, Curepipe; taken January 12th, 1935, slide 35M17-1.

LITERATURE CITED.

- (1) BERLESE, ANTONIO. 1905 (Aug. 25). "Acari nuovi, Manipulus.—IV." 'Redia,' vol. ii. pp. 154-176, pls. xv.-xvii.
- (2) ——. 1910 (Feb. 12). "Lista di nuove Specie e nuovi Generi di Acari." 'Redia,' vol. vi. pp. 242-271.
- (3) GRANDJEAN, F. 1930. "Oribates Nouveaux de la Région Caraïbe." Bull. Soc. zool. France, vol. lv. pp. 262-284, 13 figs.

- (4) JACOT, A. P. 1929 (Oct.-Nov.). "Genera of Pterogasterine Oribatidæ (Acarina)." Trans. Am. Micr. Soc. vol. xlviii. pp. 416-430.
- (5) ——. 1931 (Aug. 10). "A common Arboreal Moss Mite, *Humeroobates humeralis*." Occ. Papers, Boston Soc. Nat. Hist. vol. v. pp. 369-382, pl. xix.
- (6) SELLNICK, MAX. 1921. "Oribatiden vom Zwergbirkenmoor bei Neulinum, etc." Mitteil. Westpreus. Provinz. Mus. II, Schr. Naturf. Ges. Danzig, n.f. vol. xv. Heft 3, pp. 69-77, 4 text-figs.
- (7) ——. 1925 (Dec.). "Javanische Oribatiden (Acar.)." 'Treubia,' vol. vi. pp. 459-475, 24 text-figs.
- (8) ——. 1927. "Hornmilben, Oribatei," in 'Tierwelt Mitteleuropas,' vol. iii. Lief. 3, sect. 9, 42 pp., 91 figs.
- (9) WARBURTON, CECIL. 1913. "The Acarina of the Seychelles." Trans. Linn. Soc. London, Zool. vol. xv. pp. 349-360, pls. xvii.-xix.
- (10) WILLMANN, CARL. 1932 (July 15). "Eine neue Sphæroobates-Art aus Java (Oribatei, Acari)." Zool. Anz. vol. xcix. pp. 174-176, 2 figs.

XXXIX.—*The Javan Race of the Oriental Yellow-throated Marten*, *Lamprogale flavigula*. By R. I. Pocock, F.R.S. From the Department of Zoology, British Museum (Natural History).

JAVAN examples of this Marten were unknown to Bonhote in 1901 when he published his revision of the genus, but by Jentink they were identified as *henricii*, which occurs in Sumatra and Borneo, the type-locality being Padang. The skin and skull of an adult ♀ collected by the late H. C. Robinson suggest that the Javan form is distinct.

Lamprogale flavigula robinsoni, subsp. n.

Locality of Type.—Tjibodas, W. Java, 5000 ft.

As large as *peninsularis* of the Malay Peninsula, larger than *henricii*, and distinguished from both by the top of the head, the nape between the dark brown stripes and the shoulders being grey instead of brown or yellowish brown, also by the white of the lower cheek being more extensive and invading the brown area just behind the corner of the eye; the sides of the neck, throat, and chest are white not yellow, and the belly is chocolate-brown, darker than in the darkest skin of *peninsularis*.

The flesh-measurements of the type, ad. ♀ (B.M. no. 36. 2.16.1), are: head and body 461 mm., tail 360 mm.,

hind foot 91 mm., ear 33 mm. The skull has a condylo-basal length of 91 mm. In the largest ♀ skull of *peninsularis* the length is 90 mm., the average of four skulls being 87 mm. The largest ♀ skulls of *henricii* from Borneo and Sumatra are respectively 82 and 81 mm., the average of six skulls from the two islands being just over 80 mm.

XL.—*The Roe-Deer of European Turkey.* By EDGAR N. BARCLAY. From the Department of Zoology, British Museum (Natural History).

THREE specimens of Turkish roe-deer recently presented to the British Museum (Nat. Hist.) by Mr. F. E. Whittall are of particular interest, since they serve to show the connection between *Capreolus capreolus cori*, the pale grey variety from Kurdistan, and the more typical buffish races of central and western Europe. Mr. Whittall's specimens are much closer to *cori* than to any known European race, which seems to dispose of the assumption that *cori* is an isolated race of desert type. This conclusion, however, presupposes the fact that the Bosphorus does not represent a physical barrier to the distributional movements of these deer, but, though I have no direct evidence of their crossing, roe are powerful swimmers and would, I think, have little difficulty in crossing these narrow straits. Mr. Whittall informs me that they are plentiful in both Turkey and Asia Minor, a fact which would probably encourage the interchange of individuals. The roe-deer from European Turkey are much paler than *C. c. armenius* from Sumela, 30 miles south of Trebizond, though probably the darker colour of the latter race is related to the excessive dampness of their habitat. The chief point of difference between the roe of Kurdistan and those of Turkey concerns the coloration of the feet and legs. In the former variety these are of the same pale grey colour as the body, but in the latter they are buffish as in typical *C. c. capreolus*. In this respect, therefore, the Turkish roe differs markedly from *cori*, and it is readily distinguishable from all European races on account of its pallid body-colour; it may therefore be subspecifically separated.

Capreolus capreolus whittalli, subsp. n.

Essential characters as in *C. c. coxi*, but differing from the members of that race in the coloration of the feet and legs, which are buff, fading into buffish grey above the knees. General colour of upper parts a pallid buffish grey, darker along the spine than on the flanks; underparts grey, faintly washed with yellowish; face grey, not darker than dorsal surface; crown of head dark brown with a pronounced dorsal line of the same colour extending to the nape of the neck; throat and neck-patches white, but small and indistinct; outer surfaces of ears the same dark brown as the crown of the head, but faintly ticked with buff; inner surfaces whitish, edged with dark brown; rump-patch white, edged with buff. Summer pelage unknown.

Type.—Adult male in winter pelage (B.M. no. 35. 10.20.7)

Locality.—Near Alemdagh, 15 miles from Moda, Istanbul.

Cranial Measurements (skull imperfect).—Greatest breadth over orbits 87 mm.; interorbital breadth 48·3; zygomatic breadth 85·5; greatest breadth of palate 41; lower tooth-series 67·2.

The two other specimens presented by Mr. Whittall, a male and female from the same locality, agree very closely in coloration and size with the type-specimen. There are no skulls in the material representing *coxi*, but to judge by a comparison of the hoofs and antlers *whittalli* is slightly larger than *coxi*, though smaller than the roe of Central Europe and Sweden.

XLI.—*The Ova and Larvæ of Mugil capito Cuv. from Lake Qarun, Egypt.* By R. S. WIMPENNY, M.Sc., Fisheries Laboratory, Lowestoft.

THE eggs and early larvæ of *M. capito* Cuv. have not yet been described with certainty, though an egg and newly hatched larva thought to belong to this species have been described by Raffaele (5). The species is extremely common in Egypt, where vast numbers of mature fish leave the delta lakes each autumn to spawn in the sea.

In the early part of the year the result of this spawning is apparent in the large shoals of the young scaled fry which enter the lakes and fresh-water drains. Nevertheless, in spite of plankton investigations in the neighbouring sea, planktonic eggs have not been found. The adult spawning fish are not present in the trawl catches which come from some little way off-shore, but are only caught in the shore seines.

The presumption has been, therefore, that the spawning ground is situated in the littoral zone, and there has been a temptation to think that the eggs must be demersal in the water in which they are produced. The observation of Sanzo (6) on the artificial fertilization of the egg of *Mugil cephalus* (Linn.) lent support to this idea, for in this species he found that the egg only floated for a short time.

M. cephalus and later *M. cephalus* and *M. capito* fry have been introduced into Lake Qarun, which lies about 200 km. south of Alexandria (fig. 1). This lake is deeper than those of the delta, and, as there is no outlet, the water is slowly becoming saltier, particularly away from the places where the fresh-water drains enter. At the time of the original introduction it was hoped that the species first mentioned might find a salinity gradient in the lake similar to that of its coastal habitat and in which it would breed. As breeding did not take place, a policy of continuous stocking was resorted to, and it was during this period that *M. capito* was introduced (Wimpenny (8), Wimpenny and Faouzi (9)).

In these circumstances, and because of an increase in the stock of adult *M. capito* in the lake in 1934 and 1935 that was out of all proportion to the fry introduced and could only be explained by breeding taking place in the lake, it was a matter of surprise and gratification to find pelagic eggs and larvæ that could only be referred to this species. They were taken in a ten-minute tow-net haul made at the surface one kilometre east of Geziret Quallieh, a position indicated by a cross in fig. 1. The net used was of the "International" type described by Ostenfeld and Jespersen (4), and was furnished with silk having 58 meshes to the linear inch. October 24th, 1934, the day on which the catch was made, was one of considerable wind. As the depth of the lake at this place is only about three metres, it seems very possible

that these eggs were distributed through water by currents and turbulence, as the salinity at this place, though high for a lake (circa 20 per mille), is not as high as the

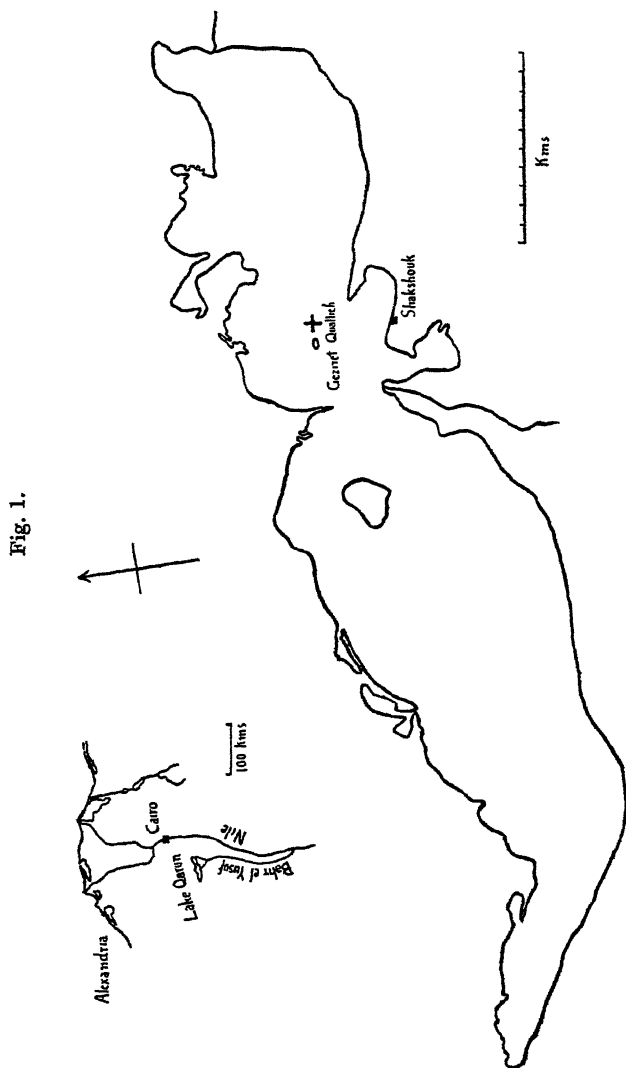


Chart showing situation of Lake Qarun and position in it from which *M. capito* ova and larvæ were taken.

Mediterranean sea-shore, where they have not been found. Further investigations on calm days should, however, settle the question of flotation.

The haul under consideration revealed five larval fish and a score or so of ova, of which I have figured three representative ova stages and the same number for the larvæ.

I am indebted to Dr. Hussein Faouzi, the Director of Fisheries Research, Egypt, for arranging the collection and despatch of the sample and to Dr. M. K. Sabi of the Marine Fisheries Laboratory, Alexandria, for making the actual collection.

THE OVA.

The ova I have examined varied in diameter from .66 to .80 mm. They are therefore considerably smaller than that figured by Raphaele (5). The water is less salt than the Mediterranean at Naples, and on that account if the two samples were of the same species those of Lake Qarun might have been expected to be bigger. On the other hand, the temperature of Lake Qarun in October is likely to be higher than the Mediterranean water, and this effect would probably work in the opposite direction. In all stages the ova possess an unusually large and characteristic oil-globule measuring from .2 to 5.30 mm. in diameter.

The larger ovum figured by Raffaele had a "large" oil-globule .20 mm. in diameter. The difference is considerable, but might possibly be explained by increase of temperature lowering the surface-tension of the same oil. A faint ridging of the outer capsule, the absence of a perivitelline space, and a clear homogeneous yolk are other features held in common by all stages.

In the earliest stage ("A" in fig. 2) there is formed on the yolk a germinal cap of cells, and it is assumed that development takes place over the surface of the yolk in the way shown to occur in other teleostean fishes and well illustrated for the cod by Meek (3).

The next and most common stage is that shown in "B" of fig. 2. The embryo has spread over the yolk, the alimentary canal has formed, and there are four irregular lines of dark brown pigment-spots scattered over the dorsal surface. There are also extensive lobes on either side of the head, but eyes are not yet visible.

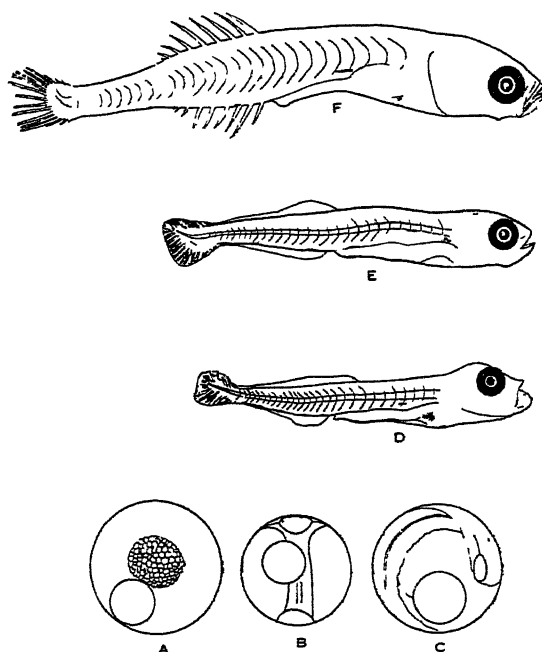
In the later stage of development ("C" in fig. 2) the general appearance is similar to the last, except that the

eye has been developed. The eye, however, is without pigment.

THE LARVÆ.

The young fish observed, and of which the stages are figured here, have two common characters. These are, firstly, the possession of twenty-nine vertebral segments and, secondly, the occurrence of a dark brown pigment-spot ventral to the fourth and fifth vertebræ.

Fig. 2.



Ova and larvæ of *M. capito*. For explanation of letters, see text.

The first stage ("D" in fig. 2) is already 4.5 mm. long and the yolk-sack has almost disappeared from a position ventral to the branchial region. There is a continuous fin running from about midway down the back to the anus, a pectoral fin is present, and the tail is homocercal. The simple alimentary canal ends on the tenth vertebral segment and considerably more than

halfway down the body. There are several dark brown pigment-spots distributed over the ventral part of the body. One occurs on the ventral surface of the branchial part of the throat, another ventral to the fourth and fifth vertebræ, and four others are distributed evenly between the anus and the tail along the base of the ventral fin. Teeth are absent.

The next stage ("E" in fig. 2) is 5.15 mm. long. The general disposition of the fins is similar to the foregoing stage. The tail, however, has become heterocercal, a ventral expansion of the caudal lobe corresponding to a dorsal bending of the terminal vertebræ. The alimentary canal is still simple and ends on the tenth vertebral segment more than halfway towards the tail, but is, nevertheless, relatively shorter than in the first stage. The pigment-spot under the fourth and fifth vertebræ persists, and there are also a few very small dots of pigment on the dorsal surface of the head a little behind the eyes. Dark brown pigment-spots are situated at four places on the ventral part of the body: namely, dorsal and ventral to the anus, on the base of the ventral fin at the thirteenth and twentieth vertebral segments, and in the caudal region just below the point where the vertebral column begins to bend upwards. In this stage teeth are visible for the first time, there being four on the upper and three on the lower jaw for the side figured.

The last stage ("F" in fig. 2) measures 7.08 mm. The continuous fins have disappeared and localized fins with spiny rays have taken their place. On the back and extending from the tenth to the eighteenth body-segment there is a dorsal fin composed of nine spines. The caudal fin is likewise composed of spinous rays, of which there are nine above and eight below the middle line in the individual figured. The tail so composed is homocercal. A ventral fin of nine spiny rays occurs behind the anus from segment 10 to segment 18. It thus corresponds exactly to the dorsal fin. No anterior dorsal fin was observed, but, as the anterior dorsal part of this specimen was bruised, it is possible that it may have been torn away. The anus opens on the ninth segment and is very slightly more than halfway down the body. It therefore continues the

process of relative shortening begun in the last stage described. The characteristic pigment-spot under the fourth and fifth vertebræ still persists, but elsewhere there are only two faint flecks. The first of these is at the base of the third spine of the ventral fin, and the second in the mid-ventral line at the level of the twenty-first segment. Conical and pointed teeth are more numerous at this stage, and there are shown on the right side of the upper jaw twelve, whilst the corresponding part of the lower jaw bears four.

Holt (2) has figured an early larva of *Mugil* sp. on which there is not only more dark pigment than on any of the stages described here but there is an abundance of yellow pigment absent from my specimens. In this connection it must be stressed that the material described here has all been preserved in weak formalin, and it is quite possible that yellow pigment originally present may have disappeared in the time between collection and examination.

THE NUMBER OF VERTEBRÆ IN *MUGIL CAPITO*.

The vertebral count of the three larval and post-larval stages just described may be summarized as follows:—

	Pre-anal.	Post-anal.	Total.
Specimen "D"	10	19	29
" "E"	10	19	29
" "F"	9	20	29

On the other hand, the number of complete vertebræ observed for two scaled fry taken near Alexandria in 1924 and for eight others taken at the same place in 1933, all being between 20 and 30 mm. in length, was twenty-four. This number is the one given by Boulenger (1) as characteristic of the genus *Mugil*. It is unfortunate that I have no scaled fry of the Qarun generation to compare with those from the original stock near Alexandria. Nevertheless, the probability of the twenty-nine vertebræ in the Qarun larvæ and post-larvæ representing a real and persistent difference is supported by the drawing of a *Mugil* sp. 3.17 mm. long, given by Holt (2), and showing twenty-four myomeres.

In these circumstances it looks as if transfer to a less salt and probably warmer environment has increased the number of vertebræ in *Mugil capito*. If this is so,

the case is an interesting parallel to that of Schmidt (7), who showed that *Zoarces vivipara* taken from a salinity of about 21 per cent., and introduced into a somewhat warmer area having a salinity of about 12 per cent., produced a brood whose mean vertebral count was higher than that of the mother population (114.8/113).

SUMMARY.

The eggs and larvæ of *Mugil capito* have been found in a brackish Egyptian lake, whither the parents had been introduced as fry from the coastal region 200 km. distant.

The egg measures .66–.80 mm. and has an unusually large oil-globule of from .25–.30 mm. in diameter. It is smaller than that thought to belong to the same species by Raffaele, but the oil-globule is much bigger.

The larvæ and post-larvæ all possess twenty-nine vertebræ and bear a characteristic dark brown pigment-spot ventral to the fourth and fifth vertebræ. In the possession of twenty-nine vertebræ these fish differ from the genus *Mugil* as a whole and on the evidence available from the parent stock.

BIBLIOGRAPHY.

- (1) BOULENGER, G. A. 'Catalogue of the Fresh-water Fishes of Africa in the British Museum,' vol. iv. p. 79.
- (2) HOLT, E. W. L. "Recherches sur la Reproduction des Poissons osseux." 'Annales du Musée d'Histoire Naturelle de Marseille.—Zoologie,' Tome v. 1899.
- (3) MEEK, A. "The Development of the Cod." Min. of Agric. & Fish, Fishery Investigations, ser. ii. vol. vii. no. 1, 1924. (London.)
- (4) OSTENFELD, P. H., & JESPERSEN, P. "Standard Net for Plankton Collections." 'Publications de Circonstance,' no. 84, 1924. (Copenhagen.)
- (5) RAFFAELE, F. Mitteil. zool. Station Neapel, vii. p. 34, Tav. I. und II., 1888.
- (6) SANZO, L. "Uova e larvi di *Mugil cephalus* Cuv. attenuate per fecondazione artificiali." R. Comitato Tallassografico Italiano, Mem. clxxix, 1930.
- (7) SCHMIDT, J. "Experimental Investigations with *Zoarces vivipara* L." Comptes-Rendus des travaux du Laboratoire de Carlsberg, vol. xiv. no. 5, 1919.
- (8) WIMPENNY, R. S. 'Reports on the Fisheries of Egypt for the Years 1928, 1929, and 1930. Government Press, Cairo, 1930, 1931, and 1932.
- (9) WIMPENNY, R. S., & FAOUZI, H. "The Breeding of a Grey Mullet, *Mugil capito* Cuv., in Lake Qarun, Egypt." 'Nature,' vol. cxxxv. p. 1041, June 22, 1935.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 100. APRIL 1936.

XLII.—*New Species of Atænius allied to A. cribrithorax Bates (Coleoptera, Scarabæidæ).* By HOWARD E. HINTON, B.Sc., F.R.E.S. (Zoological Laboratory, Cambridge).

WHILE engaged in describing and figuring the species of *Atænius* for a revision of the genus to appear at a much later date, the series labelled as *Atænius cribrithorax* Bates in my collection was found to be in reality a complex of closely related species not satisfactorily separable without recourse to the characters of the structure of the male genitalia, which here exhibit greater and more striking differences between the species than in any other group of this genus. This means that it is mostly impossible to associate females with their respective males. Similar conditions in other genera of the Scarabæidæ are rare, but not unknown. A case in point is the well-known work of Dawson (1919–20, 1921, 1922, 1931, 1932, 1933) on the genus *Serica*. The recent work of W. J. Brown (1934) on the Elateridæ, of the genus *Dalopius*, shows that several British Columbian species are only separable on the characters of the male genitalia, and in these cases Mr. Brown has not been able to associate the females before him with their respective males.

It may be well to remark that all the genitalia examined conformed exactly to particular types, and there was no indication whatever of intergradation of one type with any other. Each type is so strikingly

different from any other that I can scarcely call each anything but a species. Perhaps, needless to add, I have been able to study only extremely small portions of what must be the total populations in nature, and probably only from a very small part of the geographical range of each, so that when larger series are assembled which can in any way be justly called representative of the actual populations in nature, other conclusions may be necessary.

In searching for correlated specific characters, the chaetotaxy of the legs and other parts of the body were studied with negative results. A comparison was made of the posterior wings, the mouth-parts, and even the sternal apophyses, etc., also without results.

In addition to the species present in my own collection, one male lent to me through the kindness of Mr. G. J. Arrow is described as new. For this study a total of 242 specimens were dissected, of which 143 proved to be males. For many kindly criticisms during the course of this work, my best thanks are due to Dr. A. D. Imms.

The drawings have all been made by myself with the aid of a projection apparatus. Lines next to figures represent a length of 0.20 mm. The types of the species described here are deposited in the collection of the British Museum.

Atænius arrowi Hinton, sp. n.
(Figs. 1-4.)

Male.—Length 4.4 mm.; breadth 1.8 mm. Subparallel, moderately convex. Dorsal surface nearly glabrous, but with a few sparse setæ (scarcely visible under a magnification of 144 times) at apices of elytra, and a few moderately short setæ forming an irregular fringe at sides and base of prothorax. Cuticle shining, but everywhere microscopically, densely alutaceous; piceous to dark rufo-piceous; antennæ, mouth-parts, and legs slightly paler. *Head* moderately convex, not horned; clypeal suture traceable at sides to middle two-fifths of head; clypeus broadly, moderately deeply emarginate, with the length of the inflexed portion at middle of front equal to the diameter of the base of the basal segment of the hind tarsus; sides of emargination broadly rounded, sides before genæ nearly straight; genæ nearly rectangular,

moderately prominent. Surface with no trace of rugæ on apical portion, punctures very fine (about .010 mm. in diameter) and separated by one to two times their diameters, these punctures becoming slightly finer and more

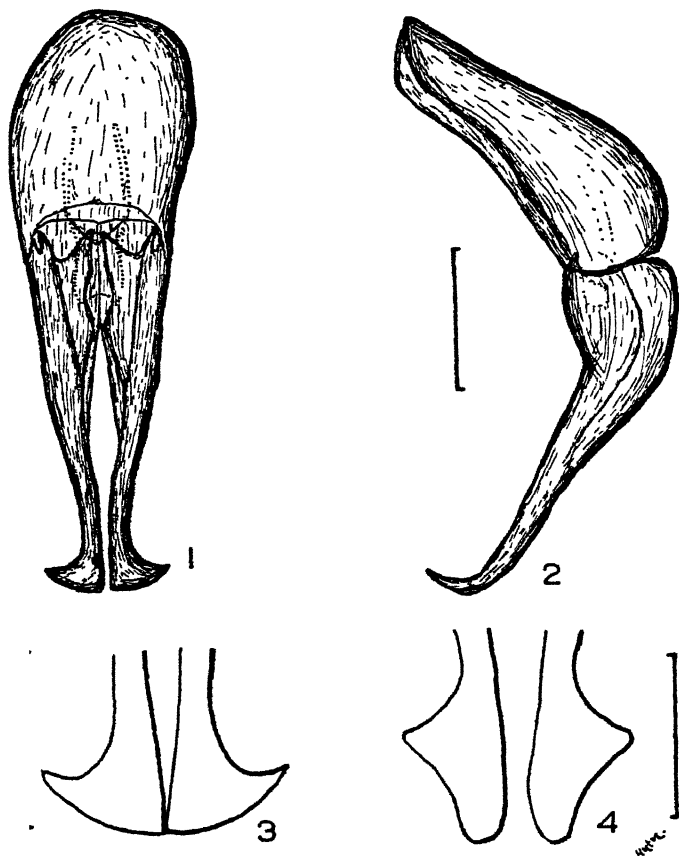


Fig. 1.—Dorsal view of male genitalia of *A. arrowi*, sp. n.

Fig. 2.—Lateral view of same.

Fig. 3.—Apex of parameres when viewed dorsally (exclusive of deflexed end) of same.

Fig. 4.—Deflexed apex of parameres of same when turned so as to lie dorsally.

indistinct towards front ; basal portion of head (behind clypeal suture) without a belt of coarser punctures. *Prothorax* moderately strongly and evenly convex ; at

broadest point near basal one-third broader than long (1.67 mm. : 1.15 mm.); sides moderately arcuate, feebly converging towards apex, deeply and distinctly margined; base feebly, evenly arcuate, deeply and distinctly margined; apical and basal angles broadly rounded. Surface of pronotum with two sizes of punctures distributed as follows:—Fine punctures about as fine as those of head, generally separated by two to three times their diameters, though on anterior portion of disk they are separated by one to two times their diameters; coarse punctures usually about twice as large as fine (a few are intermediate in size), coarsest near antero-lateral margin, where they are usually separated by less than half their diameters (though never confluent), elsewhere separated by one to three times their diameters and antero-medially even sparser. *Elytra* more than twice as long as prothorax (2.62 mm. : 1.15 mm.), about as broad at base as base of prothorax, one-third longer than greatest breadth at basal two-fifths (2.62 mm. : 1.82 mm.) and at humeri narrower than at basal two-fifths (1.50 mm. : 1.82 mm.). Humeri feebly dentate. Intervals feebly convex, at apex strongly convex, discal intervals broader than sutural interval (.144 mm. : .084 mm.); sides of intervals more strongly alutaceous than their apices, surface microscopically punctate (visible under a magnification of times 72) with punctures which are separated by three to five or more times their diameters, these punctures not becoming denser at sides of elytra. Striæ one-seventh as broad as sutural interval; discal stria punctures about one and one-half to two times as long as broad, and usually separated by slightly more than their own lengths. Scutellum punctate as intervals; without depressions of any sort. *Mesosternum* as usual in the genus confluent punctate; carina between coxæ broad and moderately convex. Metasternal disk with the median impression broad and deep, but slightly broader and deeper at each end; surface of disk with the punctures slightly coarser than fine ones of pronotum, and generally separated by one to two times their diameters; sides anteriorly near metasternal disk with about eight slightly coarser and denser punctures, extreme sides of metasternum more strongly alutaceous than elsewhere, and eroded so as to appear very shallowly, indistinctly, and often contigu-

ously punctate. Abdomen entirely punctate, the punctures on the middle being as fine or slightly coarser than fine pronotal punctures, and separated by one to three times their diameters; towards sides the punctures become coarser and denser and at sides they are shallow, coarser than coarser punctures of pronotum, occasionally confluent, and seldom separated by more than one-half to once their diameters. Front leg with the first segment of the tarsus but slightly longer than second; posterior face of femora with twenty-five to thirty very finely setose punctures, which vary in size from finer than coarse pronotal punctures to being distinctly coarser, and are occasionally confluent, but are usually separated by one-half to once their diameters, anterior portion of the femora free of these punctures, but with a few punctures finer than those of head. Middle femora with the marginal line present on apical one-half on one leg and apical three-fifths on the other; punctate similarly to anterior portion of posterior face of front femora; tibia with the accessory spinule closely adjacent to the shorter spur, without intervening spinule of the terminal fringe. Hind femora with the marginal line present on apical two-fifths, punctate similarly to middle femora; first tarsal segment slightly longer than longer spur, and slightly longer than the combined length of the remaining segments. Genitalia as figured.

Female.—Unknown.

Types.—Galapagos Is.: James Is., 20–22. ii. 1925 (G. Bateson).

Comparative Notes.—This species bore the label "*Atænius cribrithorax* var." in Dr. Van Dyke's handwriting. In Schmidt's key to the species (1922, 'Das Tierreich,' xlv.) it traces to caption "66," but differs from *A. opatroides* (Blanch) (1837–1843) as follows:—(1) Size smaller, 4.4 mm. : 5 mm.; (2) form subparallel, not suboval; (3) base of head without a belt of coarser punctures; and (4) basal segment of hind tarsus longer instead of shorter than the combined length of the following segments. Apart from the great difference in the distribution of *arrowi* Hntn. and *strigatus* Say, the two species may be separated by two readily noticeable differences:—(1) In *strigatus* there is a distinct belt of coarser punctures at the base of the head; and (2) the

genitalia of the male have no lateral projections at apices of parameres as are found in *arrowi*.

The structure of the male genitalia would seem to place this species in the *A. cribrithorax* group of the genus, though it differs externally from this group in that the head has no trace of rugæ anteriorly, but here it is well to note that in some species, as shown by Fall (1930) for *strigatus*, the anterior portion of the head may or may not be rugose. Also, the punctures of the elytral intervals are not denser on the lateral than on the discal intervals.

Atænius duplex Hinton, sp. n.
(Figs. 5-7.)

Male.—Length 4 mm.; breadth 1.6 mm. Subparallel, moderately convex. Dorsal surface nearly glabrous, but with a few sparse setæ (scarcely visible under a magnification of 144 times) at apex and extreme sides of elytra and with a few moderately short, stout setæ forming an irregular fringe (setæ in my specimens appear to have been badly rubbed) at sides and base of prothorax. Cuticle shining; on the dorsal surface the disk of the pronotum and elytra not alutaceous (mag. 144), elsewhere feebly, microscopically alutaceous; piceous to dark rufo-piceous; antennæ, mouth-parts, and legs slightly paler. *Head* moderately convex, not horned; clypeal suture traceable at sides to middle half of head; clypeus broadly, moderately deeply emarginate with the length of the deflexed portion at middle of front slightly greater than the diameter of the basal segment of the hind tarsus; sides of the emargination broadly rounded; sides before genæ feebly arcuate; genæ moderately prominent, obtusely rounded. Surface with moderately feeble transverse rugæ on about anterior three-fifths, the rugæ becoming slightly denser and more prominent towards front; with a feebly defined belt of punctures behind clypeal suture, which vary from .014 to .010 mm., and are usually separated by three-fourths to one and one-half their diameters, anterior to this belt the punctures are slightly finer and shallower to rugose portion. *Prothorax* evenly and moderately strongly convex; at broadest point near basal one-third about one-third broader than long (1.475 mm.: .975 mm.); sides moderately arcuate, feebly converging towards front, deeply and distinctly

margined; base scarcely noticeably bisinuate, deeply and distinctly margined; apical angles obtusely rounded, basal broadly truncate, with the angle on each side of the truncation broadly rounded. Surface of pronotum with two sizes of punctures distributed as follows:—Fine punctures about as fine as those of head and separated usually by about five to ten times their diameters, and by three to five times their diameters anteriorly on disk,

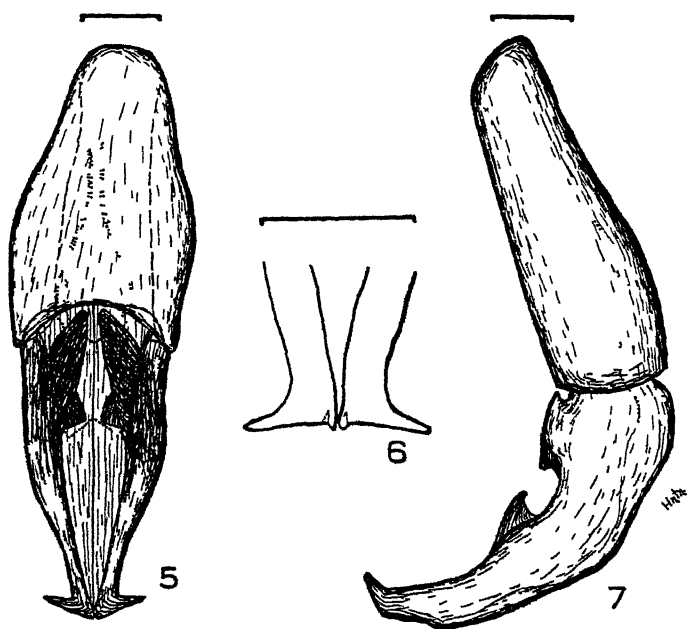


Fig. 5.—Dorsal view of the male genitalia of *A. duplex*, sp. n.

Fig. 6.—Dorsal view of apex of the parameres of the same.

Fig. 7.—Lateral view of the same.

absent on sides; coarse punctures generally from .024 mm. to .048 mm. in diameter, though occasionally nearly as small as fine punctures, at sides usually separated by distinctly less than half their diameters and sometimes confluent, towards middle of disk becoming sparser, and at middle they are present mostly on basal three-fourths, where they are separated by less than to three times their diameters. *Elytra* twice as long as prothorax (2.32 mm. : .975 mm.), about as broad at base as base of

prothorax, about one-third longer than the greatest breadth at one-half (2.32 mm. : 1.6 mm.) and at humeri narrower than at one-half (1.35 mm. : 1.6 mm.). Humeri moderately feebly dentate. Intervals feebly convex (on disk apparently flat), at apex and sides more strongly convex, discal intervals broader than sutural interval (.108 mm. : .072 mm.); surface with the punctures as fine as finest of head and separated by three to ten or more times their diameters, at sides and apex punctures generally about twice as coarse and usually somewhat denser. Striæ about one-sixth as broad as sutural interval; discal strial punctures are usually oval and separated by twice their diameters, these punctures coarsely but shallowly crenating sides of intervals. Scutellum without impressions. *Mesosternum* as usual in the genus confluent punctate; carina between coxæ broad and moderately convex. Metasternal disk with the median impression broad and deep and slightly broader and deeper at each end; surface of disk with the punctures varying in size to the same extent as those of basal portion on head and separated by three to five times their diameters; extreme sides densely, microscopically alutaceous and confluent punctate with punctures which are slightly coarser than coarsest pronotal punctures, anteriorly and nearer disk the punctures become finer, less frequently confluent, and separated by nearly as much as once their diameters; at sides of disk a few of these coarse punctures extend nearly to posterior margin. Abdomen entirely punctate, punctures on middle generally slightly finer, but occasionally much finer than coarse pronotal punctures and separated by less than to three times their diameters, towards sides becoming denser and slightly coarser and at sides seldom separated by as much as their diameters and occasionally confluent. Front leg with the first segment of the tarsus slightly shorter than the combined length of the following two segments; posterior face of femora with about twenty punctures which are similar to coarse pronotal punctures and vary in size as much as the latter, these punctures are occasionally confluent to separated by one or more times their diameters, anterior one-third to two-thirds free of these punctures, but with a few punctures finer than those of head. Middle femora with the marginal line on apical

three-fifths; punctate similarly to anterior portion of posterior face of front femora and near apex with a few shallow punctures which are about as coarse as coarse pronotal ones; tibia with the accessory spinule prominent, closely adjacent to shorter spur and without intervening spinule of terminal fringe. Hind femora with the marginal line present on apical two-fifths; punctate as middle femora; tibia with the accessory spinule similar to that of middle tibia; first tarsal segment slightly longer than longer spur and slightly shorter than the combined length of the four following segments. Genitalia as figured (figs. 5-7).

Female.—Unknown.

Type.—Male. Mexico: Dist. de Temascaltepec, Teju-pilco, alt. 4000 ft., 19. vi. 1933 (*H. E. Hinton, R. L. Usinger*).

Paratypes.—Nine males in the collection of the author with the same data as type, but collected at different times in June.

Variations.—The punctures of the basal portion of the head in a few of the paratypes are sparser than described for the type, but aside from slight variations in the density of the punctures of various sclerites, no variations worthy of mention have been noted.

Comparative Notes.—I cannot separate this species from *A. cribrithorax* Bates, to which it traces in Schmidt's key to the species (1932, 'Das Tierreich,' xlv.) by any external character known to me, but an examination of the male genitalia of the two species shows a considerable difference in structure. In *A. duplex* Hntn. (figs. 5-7) the apex of each paramere has a strong lateral projection, whereas in *A. cribrithorax* the apices are evenly narrowed and without lateral projections of any sort.

Atænius communis Hinton, sp. n.
(Figs. 8-10.)

Male.—Length 4 mm.; breadth 1.6 mm. Subparallel, moderately convex. Dorsal surface nearly glabrous, but with a few sparse setæ (scarcely visible under a magnification of 144 times) at apex and extreme sides of elytra and with a few moderately short, stout setæ forming an irregular fringe (setæ in my specimens appear to have been badly rubbed) apparently confined

to anterior sides of prothorax. Cuticle shining; on the dorsal surface the disk of the pronotum and elytra not alutaceous (mag. 144), elsewhere feebly, microscopically alutaceous; piceous to dark rufo-piceous; antennæ, mouth-parts, and legs slightly paler. Head moderately convex, not horned; clypeal suture traceable at sides to middle half of head; clypeus broadly, moderately

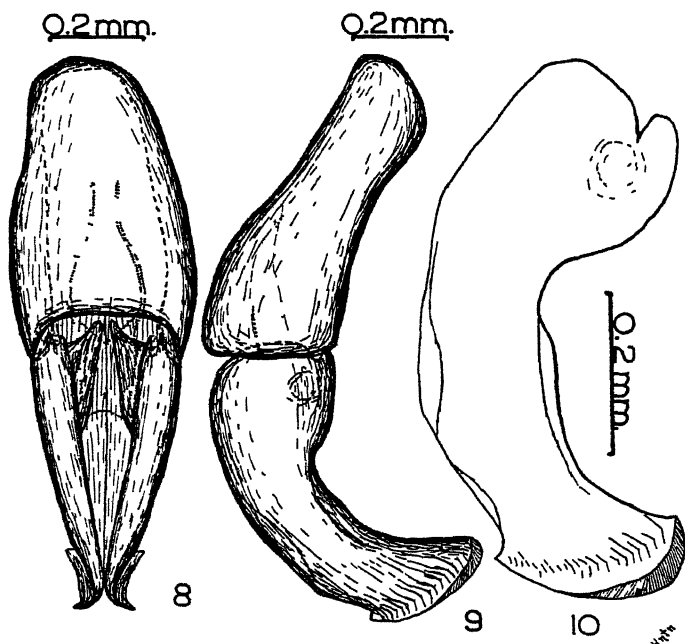


Fig. 8.—Dorsal view of male genitalia of *A. communis*, sp. n.

Fig. 9.—Lateral view of the same.

Fig. 10.—Lateral view of a paramere of the same, dissected off.

deeply emarginate with the length of the deflexed portion at middle of front slightly greater than the diameter of the basal segment of the hind tarsus at base; sides of emargination broadly rounded; sides before genæ feebly arcuated; genæ moderately prominent, obtusely rounded. Surface with feeble transverse rugæ on about one-third at middle, the rugose area becoming narrower towards sides and absent well before genæ, these rugæ become very slightly denser and more prominent towards front; with a very feebly defined belt of punctures behind clypeal suture which vary from .012 mm. to .020 mm., and are

usually separated by less than to twice their diameters, anterior to this belt the punctures are slightly finer and sparser on middle, but on a diagonal belt equally as coarse and dense (though occasionally transversely confluent), but less round and more transverse to rugose portion. *Prothorax* evenly and moderately strongly convex; at broadest point near basal one-third broader than long (1.50 mm. : 1.05 mm.); sides moderately arcuate, feebly converging towards front, deeply and distinctly margined; base scarcely noticeably bisinuate, deeply and distinctly margined; apical angles obtusely rounded, basal broadly truncate with the angle on each side of the truncation broadly rounded. Surface of pronotum with two sizes of punctures distributed as follows:—Fine punctures slightly finer than finest punctures of head (.010 mm.) and usually separated by five to ten times their diameters and by three to five times their diameters anteriorly on disk, absent on sides; coarse punctures generally from .024 to .048 mm. in diameter, though occasionally nearly as small as fine punctures of head, at sides usually separated by distinctly less than half their diameters and sometimes confluent, towards middle of disk becoming sparser, and at middle they are present mostly on basal three-fourths where they are separated by less than to about three times their diameters. Elytra twice as long as prothorax (2.37 mm. : 1.05 mm.), about as broad at base as base of prothorax, about one-third longer than the greatest breadth at one-half (2.37 mm. : 1.6 mm.) and at humeri narrower than at one-half (1.40 mm. : 1.6 mm.). Humeri moderately dentate. Intervals feebly convex (on disk apparently flat), at apex and sides more strongly convex, discal intervals broader than sutural interval (.108 mm. : .072 mm.); surface with the punctures as fine as finest of head and separated by three to ten or more times their diameters, at sides and apex punctures generally about twice as coarse and usually somewhat denser. Striæ about one-sixth as broad as sutural interval; discal stria punctures are usually oval and separated by twice their diameters, these punctures coarsely but shallowly crenating sides of intervals. Scutellum without impressions. *Mesosternum* as usual in the genus confluent punctate; carina between coxæ broad and moderately convex. Metasternal disk with the median impression broad and deep and slightly broader

and deeper at each end ; surface of disk with the punctures varying in size to the same extent as those of the basal portion of the head and separated by two to five times their diameters ; extreme sides densely, microscopically alutaceous and confluent punctate with punctures which are slightly coarser than coarsest pronotal ones, anteriorly and nearer the disk the punctures become finer, less frequently confluent, and separated by nearly as much as once their diameters ; at sides of disk a few of these coarse punctures extend nearly to posterior margin. Abdomen entirely punctate, punctures on middle generally slightly finer, but occasionally much finer than coarse pronotal punctures and separated by less than to three times their diameters, towards sides becoming denser and slightly coarser, and at sides seldom separated by as much as their diameters and occasionally confluent. Front legs with the first segment of the tarsus slightly shorter than the combined length of the following two segments ; posterior face of femora with about twenty-five punctures which are similar to coarse pronotal punctures and vary in size as much as the latter, these punctures are occasionally confluent to separated by one or more times their diameters, anterior one-third to two-thirds free of these punctures, but with a few punctures finer than finest pronotal punctures. Middle femora with the marginal line on apical one-half ; punctate similarly to anterior portion of posterior face of front femora and near apex with a few shallow punctures which are about as coarse as coarse pronotal ones ; tibia with the accessory spinule prominent, closely adjacent to shorter spur and without intervening spinule of terminal fringe. Hind femora with the marginal line present on apical two-fifths ; punctate as middle femora ; tibia with the accessory spinule similar to that of middle tibia ; first tarsal segment slightly longer than the longer spur and shorter than the combined length of the four following segments. Genitalia as figured (text-figs. 8-10).

Female.—Unknown.

Type.—Male. Panama : Canal Zone, Ciricito, 25. ii. 1930 (*R. E. Blackwelder*).

Paratypes.—13 males with same data as type, 22 males, Panama : Potrerillos, 1934 (*Vinson Brown*), and one male, Panama : Old Panama, 3. i. 1911 (*E. A. Schwarz*).

Variations.—The punctures of the head are often sparser and slightly finer than described for the type, but, apart from minor variations in the punctation, no other variations have been observed.

Comparative Notes.—As may be seen by a comparison of the description of this species with that of *A. duplex* Hntn., the two species are nearly identical as regards external morphological characters, there being (in the series before me) only one reliable difference which is a difference in the density and size of the punctures of the head. In the most densely punctate specimen of *A. duplex* the punctures on a sub-lateral area in front of basal belt are very seldom transversely confluent, are usually separated by as much as their diameters, and are mostly less than .014 mm. in diameter, whereas in the most sparsely punctate specimen of *communis* the punctures are often transversely confluent, are seldom separated by as much as their diameters, and are often .024 mm. in diameter. In *communis* there are very rarely punctures on the head which are as fine as finest of pronotum, whereas in *duplex* many of the cephalic punctures are as fine as finest of pronotum. The remarkably different male genitalia will separate it from *duplex* and the other members of the *cribrithorax* complex.

Atænius panamensis Hinton, sp. n.

(Figs. 11–13.)

Male.—Length 4 mm.; breadth 1.60 mm. Sub-parallel, moderately convex. Dorsal surface nearly glabrous, but with a few sparse setæ (scarcely visible under a magnification of 144 times) at apex and extreme sides of elytra, and with a few moderately short, stout setæ forming an irregular fringe (setæ in my specimens are undoubtedly badly rubbed) apparently confined to anterior sides of prothorax. Cuticle shining; on the dorsal surface the disk of the pronotum and elytra not alutaceous (mag. 144), elsewhere feebly, microscopically alutaceous; piceous to dark rufo-piceous; antennæ, mouth-parts, and legs slightly paler. Head moderately convex, not horned; clypeal suture barely traceable at sides to middle half of head; clypeus broadly, moderately deeply emarginate with the length of the deflexed portion at middle of front slightly greater than the diameter

of the basal segment of the hind tarsus at base ; sides of emargination broadly rounded ; sides before genæ feebly arcuate ; genæ moderately prominent, obtusely rounded. Surface with feeble transverse rugæ on about one-third at middle, the rugose area becoming narrower towards sides and absent well before genæ, these rugæ become very slightly denser and more prominent towards front ; with a very feebly defined belt of punctures behind

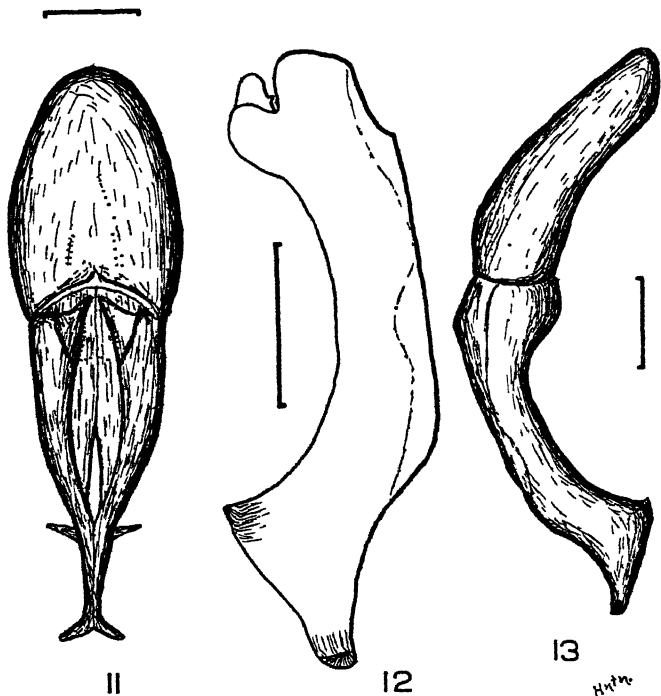


Fig. 11.—Dorsal view of the male genitalia of *A. panamensis*, sp. n.

Fig. 12.—Lateral view of a paramere of the same, dissected off.

Fig. 13.—Lateral view of the male genitalia of the same.

clypeal suture which vary from .012 mm. to about .020 mm. and are usually separated by less than to twice their diameters, anterior to this belt the punctures are slightly sparser and finer on middle, but on a diagonal belt equally as coarse and dense (though occasionally transversely confluent), but less round and more transverse to rugose portion. *Prothorax* evenly and moderately strongly convex ; at broadest point near basal one-third

broadier than long (1.47 mm. : .975 mm.); sides moderately arcuate, feebly converging towards front, deeply and distinctly margined; apical angles obtusely rounded, basal broadly truncate with the angle on each side of the truncation broadly rounded. Surface of pronotum with two sizes of punctures distributed as follows:—Fine punctures slightly finer than finest punctures of head (.010 mm. or less) and usually separated by five to ten times their diameters and by three to five times their diameters anteriorly on disk, absent on sides; coarse punctures generally from about .024 to .048 mm. in diameter, though occasionally nearly as small as fine punctures of head, at sides usually separated by distinctly less than half their diameters and sometimes confluent, towards middle of disk becoming sparser, and at middle they are rather fine on anterior one-half and coarser on basal one-half where they are separated by less than to about three times their diameters. *Elytra* twice as long as prothorax (2.30 mm. : .97 mm.), about as broad at base as base of prothorax, about one-third longer than greatest breadth at one-half (2.30 mm. : 1.60 mm.), and at humeri narrower than at one-half (1.37 mm. : 1.60 mm.). Humeri moderately dentate. Intervals feebly convex (on disk apparently flat), at apex and sides more strongly convex, discal intervals broader than sutural interval (.108 mm. : .072 mm.); surface with the punctures as fine as finest of head and separated by three to ten or more times their diameters, at sides and apex punctures generally about twice as coarse and usually somewhat denser. Striæ about one-sixth as broad as sutural interval; discal stria punctures are usually oval and separated by twice their diameters, these punctures coarsely but shallowly crenating sides of intervals. Scutellum without impressions. *Mesosternum* as usual in the genus confluent punctate; carina between coxæ broad and moderately convex. Metasternal disk with the median impression broad and moderately deep, but slightly broader and deeper at each end; surface of disk with the punctures varying in size from about as coarse as cephalic punctures to as fine as finest pronotal ones and separated by two to five times their diameters; extreme sides densely, microscopically alutaceous and confluent punctate (appearing at lateral margin somewhat eroded) with punctures which are slightly coarser

than coarsest pronotal ones, anteriorly and nearer disk the punctures become finer, less frequently confluent, and separated by nearly as much as once their diameters; at sides of disk a few of these coarse punctures extend nearly to posterior margin. Abdomen entirely punctate, punctures on middle generally slightly finer, but occasionally much finer than coarse pronotal ones, and separated by less than to three times their diameters, towards sides becoming denser and slightly coarser, and at sides seldom separated by as much as their diameters and often confluent. Front leg with the first segment of the tarsus slightly shorter than the combined length of the following two segments; posterior face of femora with about twenty-five punctures which are similar to coarse pronotal ones and vary in size as much as the latter, these punctures are occasionally confluent to separated by one or more times their diameters, anterior one-third or more free of these punctures, but with a few punctures finer than finest pronotal punctures. Middle femora with the marginal line on apical three-fifths; punctate similarly to anterior portion of posterior face of front femora and near apex with a few shallow punctures which are about as coarse as coarse pronotal ones; tibia with the accessory spinule prominent, closely adjacent to shorter spur and without intervening spinule of terminal fringe. Hind femora with the marginal line present on apical one-half; punctate as middle femora; tibia with the accessory spinule similar to that of middle tibia; first tarsal segment slightly longer than the longer spur and shorter than the combined length of the four following segments. Genitalia as figured (figs. 11-13).

Female.—Unknown.

Type.—Male. Panama: Potrerillos, 1934 (*Vinson Brown*).

Paratypes.—Twelve males with the same data as type.

Variations.—No variations worthy of mention have been noted in the series before me.

Comparative Notes.—I am unable to separate this species from *A. cribrithorax* and *communis* on any character except the structure of the male genitalia. It may be separated from *A. duplex* by the more densely and coarsely punctate head (cf. *communis*), and also by the male genitalia.

XLIII.—*New African Trichoptera*.—I.

By MARTIN E. MOSELY, F.R.E.S.

THE new species described in this paper have been collected mainly by correspondents of the Imperial Institute of Entomology and subsequently presented to the British Museum. Other species have been found amongst the Museum accessions.

I have taken the opportunity to call attention to one or two errors and corrections in previous descriptions of African species.

African material is continually arriving at the British Museum, and this paper is the first of what will probably form a series of papers describing the new species contained therein.

Family Leptoceridæ.

Leptocerina ugandanus Ulmer.

Leptocerus ugandanus Ulmer, Deutsch. Ent. Zeit. p. 20, figs. 20–21 (1931).

Leptocerina ugandanus Barnard, Trans. R. Soc. S. Afr. xxi. pt. iv. p. 350 (1934).

Leptocerina furcata Mosely, Ann. & Mag. Nat. Hist. (10) xi. pp. 302–4, figs. 10–13 (1932).

Dr. Barnard in his "South African Caddis-flies" has suggested that *Leptocerina furcata* Mosely may be synonymous with *Leptocerus ugandanus* Ulmer. An examination of the types has shown that he is correct, and it merely remains to transfer Ulmer's species to *Leptocerina*.

Oecetis aganda, nom. nov.

Oecetis punctata Mosely, Stylops, i. pt. 6, pp. 129–30 (1932).

Professor Betten has transferred *Oecetinella punctata* Navás to the genus *Oecetis**; it therefore becomes necessary under the laws of priority to rename *O. punctata* Mosely.

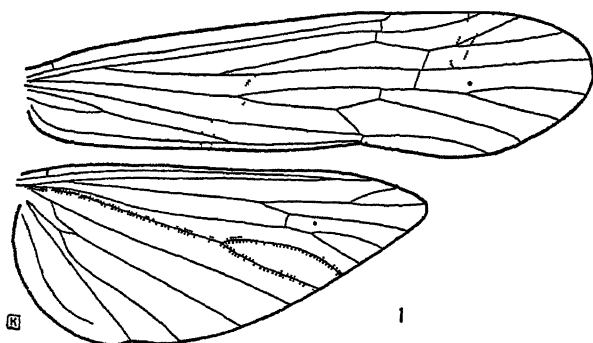
Homilia malia, sp. n. (Figs. 1–4.)

Head black, with white hairs on top and black at the sides and beneath; oculi black; antennæ black, basal joints covered with short white, hairs excepting at the

* N.Y. State Mus. Bull. no. 292, p. 274 (1934).

joints, so that they appear white, annulated with black; they are broken off rather short in the insect under description, but the remaining apical joints appear black, annulated with white; palpi black; legs black, with a few whitish hairs on the tarsi. Anterior wing shining black, with two snowy-white streaks as indicated in fig. 1, and a small white spot at the arculus extending into the fringe; there is a cross-vein uniting the subcosta and radius at the pterostigma.

Genitalia, ♂.—Dorsal surface of the ninth segment with two triangular elevations and with the apical margin extended beyond and slightly beneath, to form two triangular processes; there are two wide shallow warts



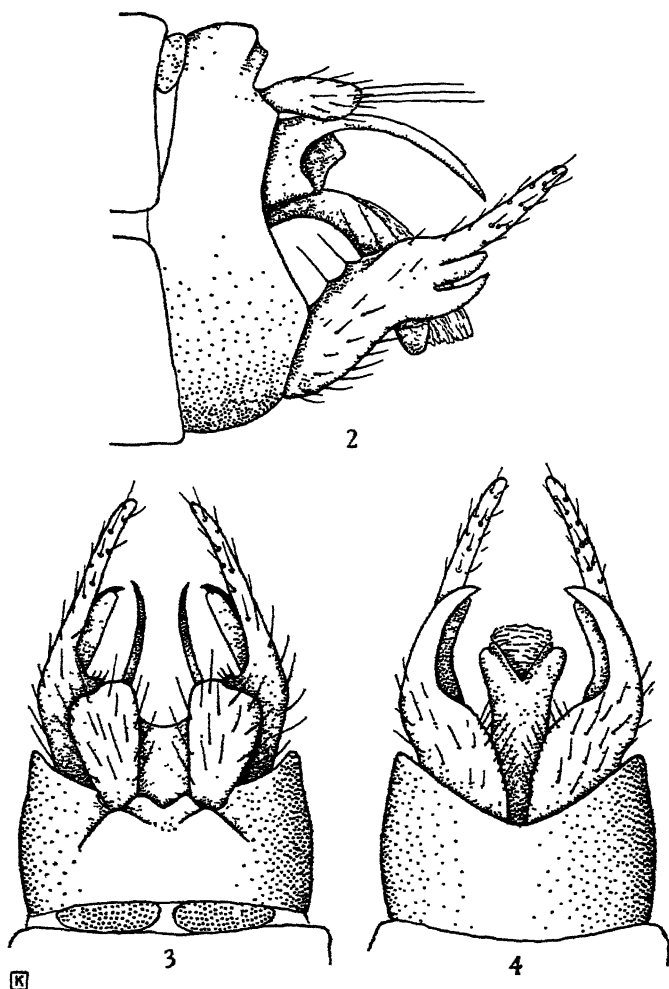
Homilia malia, sp. n., ♂. Wings.

on the basal side of the basal margin; superior appendages broad, the truncate apices with sinuate margins broader than their bases; beneath them is the upper penis-cover consisting of two down-curving spines; the bases of these, seen from the side, are very deep, and attached to them are inner plates with sinuous apical margins; penis arching downward, apex much dilated and corrugated; inferior appendages three-branched, main branch long and membranous towards the apex, second and third branches arising midway, one beneath the other, as seen from the side, all the branches incurving from above and beneath.

Length of anterior wing, ♂, 7 mm.

Sierra Leone: Njala, 31. v. 1932 (*E. Hargreaves*).

Type, ♂ (31. v. 1932), and *paratypes*, ♂ & ♀♀ (xi. 1935, 23. v. 1932, vi. 1934, same locality), in the collection of



Homilia malia, sp. n., ♂.

Fig. 2.—Genitalia, lateral view.

Fig. 3.—Ditto, dorsal view.

Fig. 4.—Ditto, ventral view, superior and intermediate appendages omitted.

the British Museum, kindly presented by the Imperial Institute of Entomology.

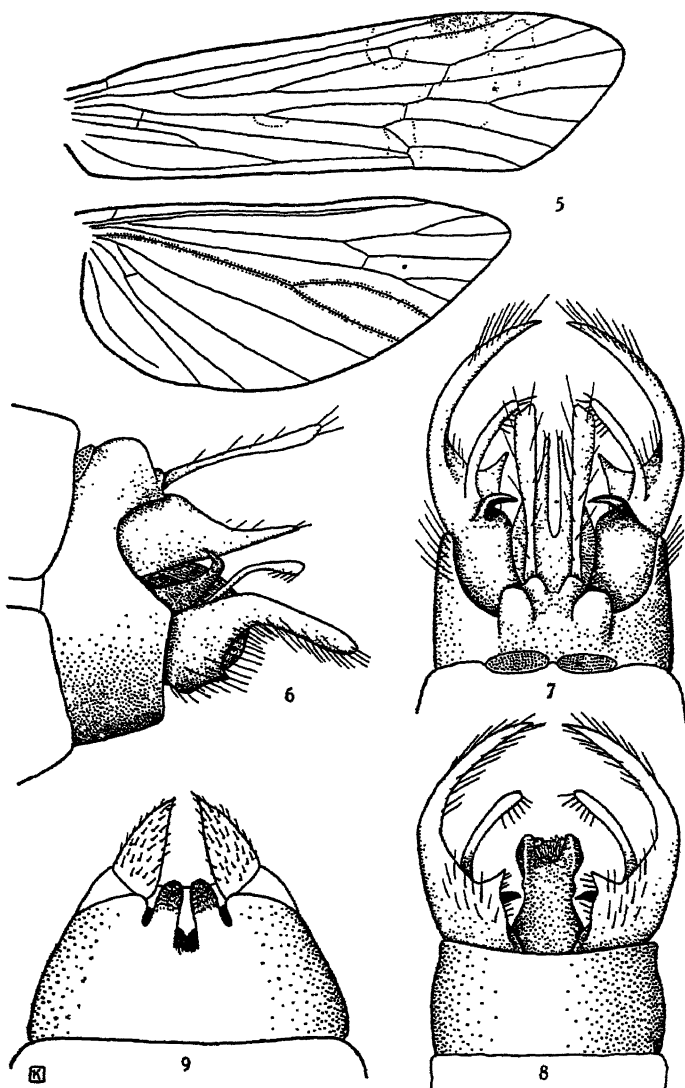
Homilia lomia, sp. n. (Figs. 5-9.)

Head dark ochraceous, with short white hairs ; antennæ dark ochraceous, with white annulations ; oculi deep black ; palpi dark ochraceous, with short white hairs ; legs dark ochraceous, tarsi with white hairs at the base of each joint ; wings, anterior undenuded, dark ochraceous, speckled with small groups of white hairs, pterostigma dark, with a white streak on its apical side extending to fork no. 5, and with various white patches on the denuded wing as shown in fig. 5.

Throughout the genus, the last anal view of the posterior wing is curved, incomplete, and follows the anal margin of the wing.

Genitalia, ♂.—Margin of the ninth dorsal segment deeply and widely excised, with two pairs of rounded processes at the centre of the excision, the anterior much larger than the distal pair ; on the basal side of the basal margin of the segment are two wide shallow warts ; arising from behind the smaller processes are the superior appendages, centrally placed, long, narrow at their bases, and with dilated and obliquely truncate apices, fringed throughout their length with long sparse hairs ; there is a large bifurcate upper penis-cover with a broad base and a narrow and deep cleft between the two forks ; penis broad at the base, dilated at its excised apex ; inferior appendages three-branched, main branches large and caliper-shaped, broad at their bases both from the side and beneath ; inner branches appear as strongly chitinated, short, inturned hooks ; between them and the main branches arise the third branches, which are lightly chitinated, incurving, and with strong bristles on their inner surfaces towards the apices ; these, from above, extend to about the apices of the superior appendages ; from the side, apices clavate ; from beneath, there is a strong tooth-like process arising from the inner margin of each appendage at about the centre of the basal half.

Genitalia, ♀.—Margin of the ninth dorsal segment with a broad shallow excision ; beyond it, from above, are two triangular plates, somewhat rectangular from the side ; the margin of the terminal ventral segment, from



Homilia lomia, sp. n.

Fig. 5.—Wings, ♂.

Fig. 6.—Genitalia, ♂, lateral view.

Fig. 7.—Ditto, dorsal view.

Fig. 8.—Ditto, ventral view, superior and intermediate appendages omitted.

Fig. 9.—Genitalia, ♀, ventral view.

beneath, is produced at its centre in two short processes directed upward between the plates.

Length of anterior wing, ♂, 7 mm.

S. Africa: Transvaal, Sabie Bridge, 10. x. 1931 (*Miss A. Mackie*).

Type, ♂, in the collection of the British Museum (from the Transvaal). *Paratypes*, ♂♀, Sierra Leone, Njala, ii.-iv. 1932 (*E. Hargreaves*).

Trienodes darfurica, sp. n. (Figs. 10-14.)

Head and thorax reddish-ochraceous, with cream-coloured hairs; oculi black; antennæ cream-coloured, with traces of dark annulations towards the base, but unicolorous elsewhere; palpi dark ochraceous; wings light ochraceous, with ochraceous pubescence.

Genitalia, ♂.—Centre of the apical margin of the ninth segment produced in two short, narrow, adjacent processes; from the side, ventral half of the segment much produced; superior appendages long and slender, fringed sparsely with long hairs; upper penis-cover from above, stout at the base and produced in two long slender parallel forks arching over the down-curving penis, which is large and fleshy; penis-sheaths, strongly chitinised, fine spines arching downward on each side of the penis; inferior appendages broad, both from the side and from beneath; from the side, the appendage is roughly diamond-shaped, the distal angle strongly produced in a narrow acute process, upper angle in a distally and slightly downwardly directed process; there is an inner plate attached to the appendage with a long upwardly produced apical angle, apex slightly truncate, the lower angle carrying two blunt spurs, inner margin carrying a row of very stout spines which interlock with similar structures of the opposite appendage; at the base is an upwardly directed branch strongly dilated towards the apex and then narrowing in a slightly basally directed finger.

Length of anterior wing, ♂, 7 mm.

W. Darfur: Jebel Murra, Killing, 7000 ft., 7. iv. 1932 (*Miss M. Steele*).

Type, ♂, in the collection of the British Museum, presented by the Imperial Institute of Entomology.

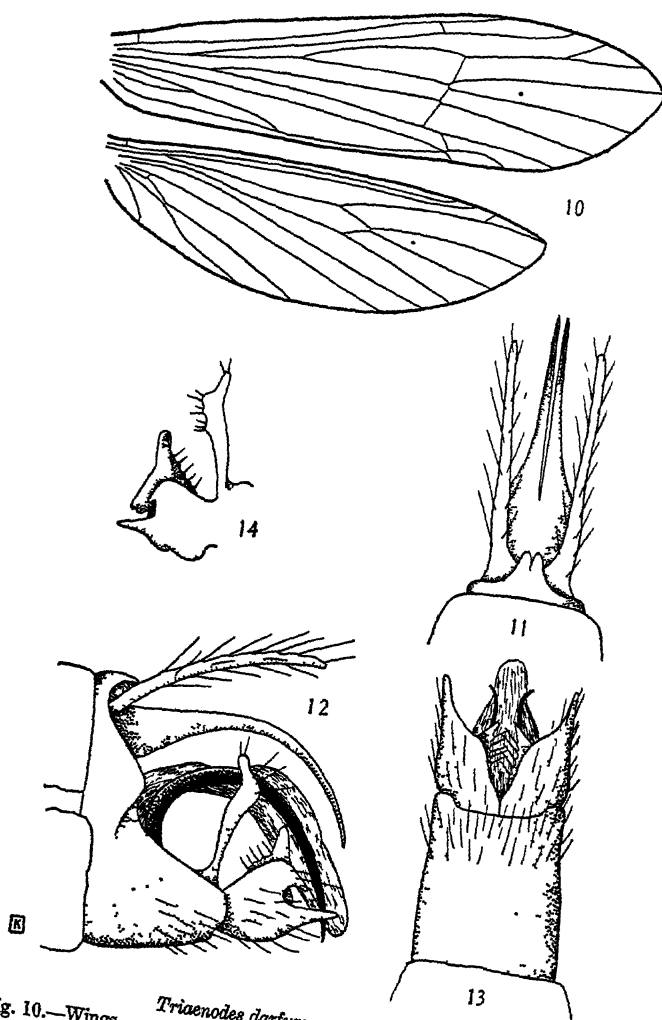


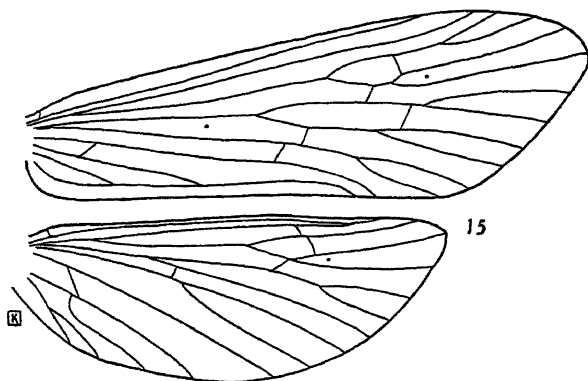
Fig. 10.—Wings. *Triaenodes darfurica*, sp. n., ♂.
 Fig. 11.—Superior appendages, upper penis-cover, etc.
 Fig. 12.—Genitalia, lateral view.
 Fig. 13.—Ditto, ventral view, superior appendages and upper penis-cover omitted.
 Fig. 14.—Obliquely lateral view of inferior appendage.

Family Hydropsychidæ.

Cheumatopsyche urema, sp. n. (Figs. 15-17.)

Head dark fuscous, oculi black, antennæ rather paler than the head, with dark annulations; palpi, legs, and sternites of the same colour as the antennæ, tergites much darker. In the anterior wing there is no cross-vein uniting the upper margin of the discoidal cell with the radius, which is rather unusual in the genus and distinguishes the species from *zuluensis* Barnard, which is very similar as regards genitalia.

Genitalia, ♂.—Dorsal margin of the ninth segment bearing two short finger-like processes, between which

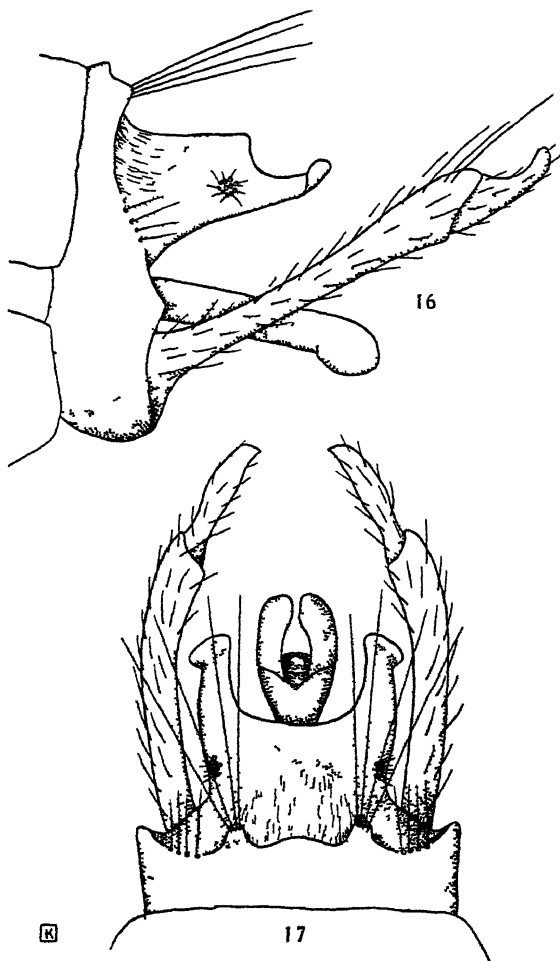


Cheumatopsyche urema, sp. n., ♂. Wings.

the margin is slightly produced and rounded; dorsal plate with the apical angles produced in long fingers with flattened apices, slightly upturned at the outer margin, leaving a wide circular excision between; a rounded wart towards the base of each finger; penis constricted before the apex, which is excised to form two large concave lobes, apparently jointed to a widened and excised base; at the base of the lobes are two small elbowed processes facing each other with their apices meeting across the excision; inferior appendages two-jointed, basal joint long, terminal joint from above with a distinct constricted portion towards the base.

Length of anterior wing, ♂, 7 mm.

Africa : Kenya, Meru, 29. i. 1934 (*C. Longfield*).



Cheumatopsyche urema, sp. n., ♂.

Fig. 16 — Genitalia, lateral view.

Fig. 17 — Ditto, dorsal view.

Type, ♂, a microscope preparation, and *paratypes*, ♂ and ♀, all from the same locality in the British Museum collection.

Cheumatopsyche digitata Mosely.

Hydropsychodes digitata Mosely, Ann. & Mag. Nat. Hist. (10) xv. pp. 228-9 (1935).

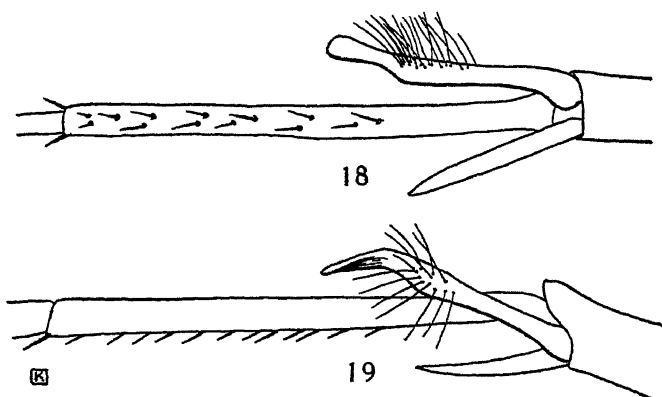
Professor T. D. A. Cockerell writes that the locality of the type of this species should read: "Belgian Congo: Bukavu, Lake Kivu, 28. viii. 1931," and not as stated on the label of the specimen and recorded in the description of the species. Tanganyika: Bukavu, L. Kuri, 28. viii. 1931.

It may be added that this and the majority of the species described under *Hydropsychodes* Ulm. are better placed in *Cheumatopsyche* Wallengr.

Family Polycentropidæ.

Dipseudopsis noricis, sp. n. (Figs. 18, 19.)

Insect rather small, brown in colour, no conspicuous pale patches on the anterior wings excepting a white



Dipseudopsis noricis, sp. n., ♂.

Fig. 18.—Specialised spur of posterior leg, outside.

Fig. 19.—Ditto, inside.

spot towards the centre close to the base of fork 5; apical fork 1 absent; the specialised spur of the posterior leg terminates in a spoon-shaped apical portion about one-third the length of the spur.

Ulmer, in the 'Deutsche Zentral Afrika Expedition,' 1907-8, p. 87 (1912), mentions an example from Kete Kratschi, Togo, with a spur of similar form, which he considered might belong to a distinct species.

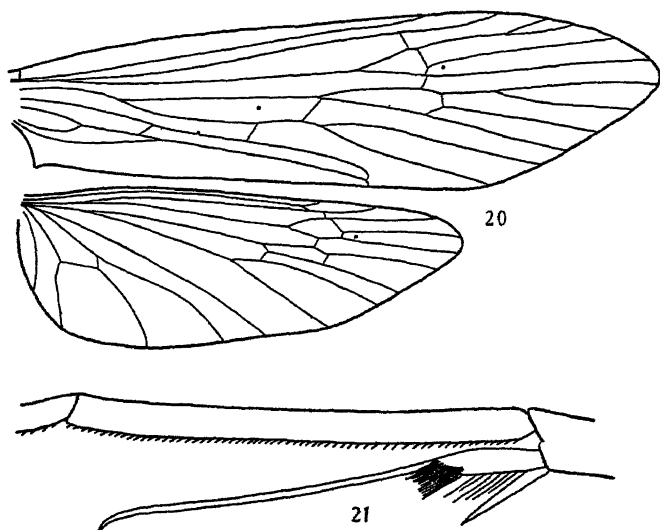
Length of anterior wing, ♂, 9 mm.

Gold Coast: Northern Territory, Navaro (A. W. Cardinall), Br. Mus. 1924-8.

Type, ♂, in the collection of the British Museum.

Dipseudopsis longispina, sp. n. (Figs. 20-24.)

Head black, oculi dark coppery; antennæ dark fuscous, paler towards the apices; palpi black; prothorax orange,



Dipseudopsis longispina, sp. n.

Fig. 20.—Wings.

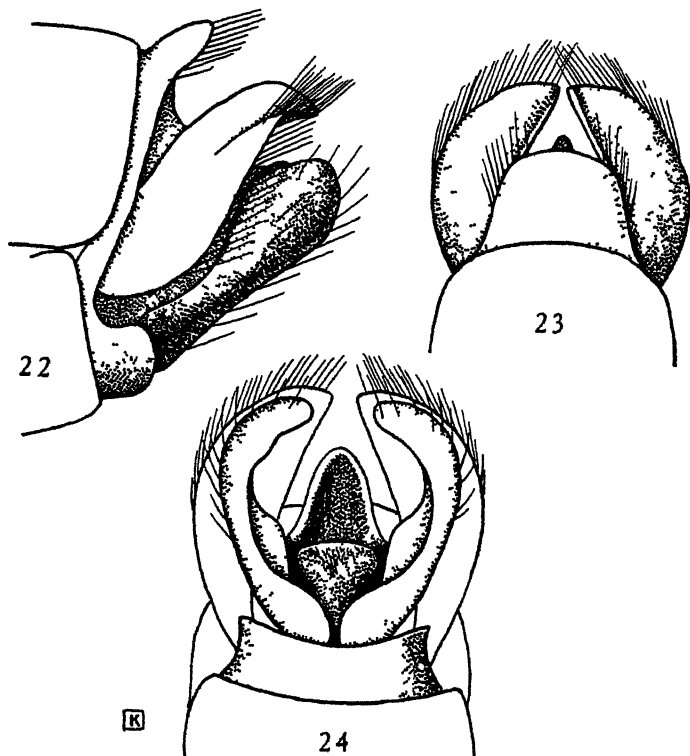
Fig. 21.—Specialised spur of posterior leg.

meso- and metathorax dark fuscous; tibia and femora dark fuscous, tarsi paler; specialised spur of the posterior leg very long and straight, nearly as long as the first tarsal joint, the basal fifth broad, remainder very slender, with slightly curved tip.

Genitalia, ♂.—Margin of the ninth dorsal segment strongly produced at its centre and fringed with long hairs; upper penis-cover hood-shaped; there is a pair of broad, lightly chitinated, intermediate appendages, apices curving inwards from above and slightly downward from the side, very heavily fringed on the lower margins, particularly at the apices; penis with a clavate apex, the underside reinforced with two chitinous plates;

inferior appendages from the side, slender at the base, clavate at the apex; from beneath, there is seen on each inner surface a central projecting ridge, and the apices are directed inwards and hollowed; the margin of the ninth segment from beneath forms a collar with somewhat pointed apical angles.

Length of anterior wing, ♂, 16 mm.



Dypseudopsis longispina, sp. n.

Fig. 22.—Genitalia, lateral view.

Fig. 23.—Ditto, dorsal view.

Fig. 24.—Ditto, ventral view.

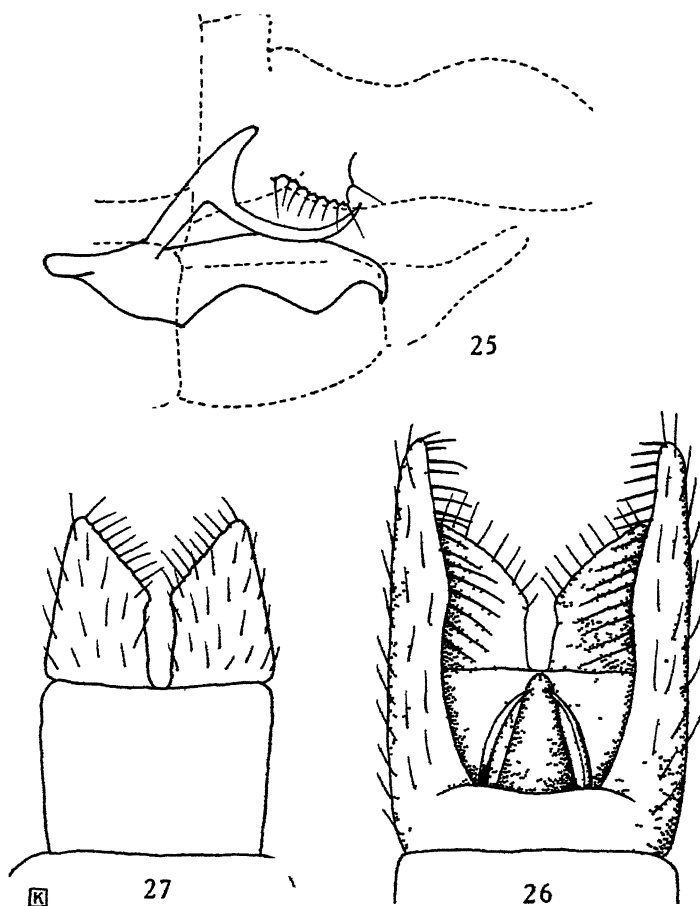
E. Madagascar: Ambinanindrano, 50 km. W. of Mahanoro (G. K. Kestell-Cornish), 22. x. 1914, 28. x. 1914, 15. ii. 1915. 3 ♂♂, one ♀ dated 11. xi. 1914, same locality.

Type, ♂, 28. x. 1914, with the abdomen and posterior leg mounted in balsam, in the collection of the British Museum.

Family *Psychomyidæ*.

Ecnomus gerus, sp. n. (Figs. 25-27.)

General appearance similar to that of *Ecnomus tenellus* Ramb. Spurs 3. 4. 4.



Ecnomus gerus, sp. n., ♂.

Fig. 25 — Genitalia, lateral view.

Fig. 26 — Ditto, dorsal view

Fig. 27 — Ditto, inferior appendages etc, ventral view.

Genitalia, ♂.—Margin of the ninth dorsal segment straight; from the side, the dorsal portion of the segment

is rather short, about half the length of the ventral part with the usual deep excision between; superior appendages welded to the segment, very long, closely resembling those of *similis*, but with the apical half, from the side, rather more dilated and the margin rather more rounded than in this species; from above, there are slight obtuse projections along the inner margins towards the apical half; there are small, strongly serrated, and fringed shelves situated on the inner surfaces towards the base and lower margin; upper penis-cover consists of a pair of incurving, and from the side, upcurving, spines, which are connected to the penis by a strongly chitinated rod-like base, meeting the penis at an acute angle as seen from the side; penis, from above, broad at the base, tapering to a small rounded apex; from the side, broad, terminating in a down-curved hook, lower margin sinuous; inferior appendages very short, with oblique truncate apices sloping towards each other as seen from beneath; from the side, broad at the base, tapering to a finger-like apex.

Length of anterior wing, ♂, 3 mm.

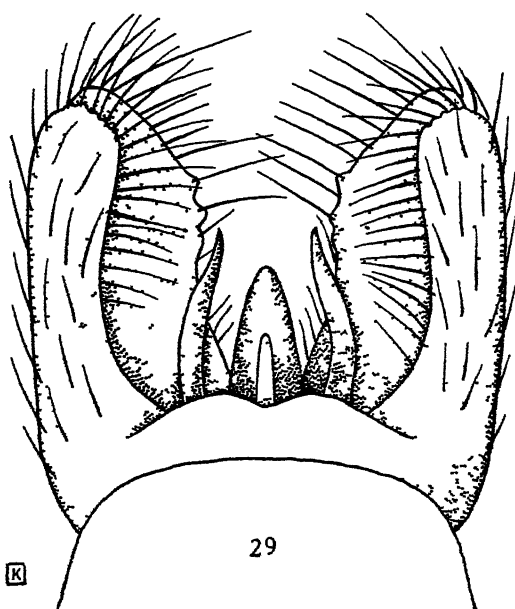
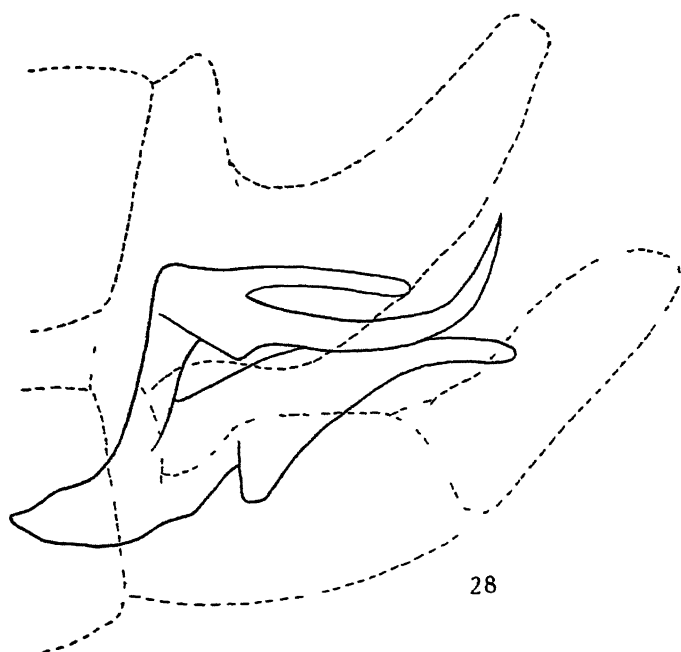
Sierra Leone: Njala, 25. vi. 1932 (*E. Hargreaves*).

Type, ♂, in the collection of the British Museum, kindly presented by the Imperial Institute of Entomology.

Ecnomus leonus, sp. n. (Figs. 28, 29.)

General appearance as that of other African species, which all resemble closely *Ecnomus tenellus* Rambur. Spurs 3. 4. 4.

Genitalia, ♂.—Margin of the ninth segment, from above, slightly produced and excised at its centre; from the side, elevated in a steep ridge; there is the usual deep lateral excision between the dorsal and ventral portions of the segment; superior appendages welded to the segment; from the side, broad at the base, upcurved and somewhat tapering towards the apex; there is a deep rounded excision at the upper margin, where the appendage unites with the ninth segment; upper penis-cover in the form of two upcurving tusks with a short finger-like rod between; penis stout at the base, where there is a projection along the lower margin, tapering to a rounded apex; inferior appendages from beneath, broad at their bases, inner margins serrate, from the side, long and nearly



Ecnomus leonius, sp. n., ♂

Fig 28 —Genitalia, lateral view

Fig 29 —Ditto, dorsal view.

rectangular; both superior and inferior appendages bearing long bristles on their inner surfaces.

Length of anterior wing, ♂, 3 mm.

Sierra Leone: Njala, 25. vi. 1932 (*E. Hargreaves*).

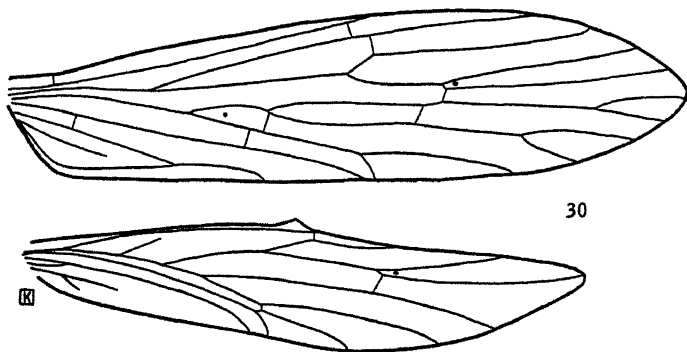
Type, ♂, and *paratype*, ♂, in the British Museum collection, kindly presented by the Imperial Institute of Entomology. *Type*, ♂, completely mounted in balsam.

Paduniella africana Ulmer. (Figs. 30-34.)

Psychomyiodes africana Ulmer, Mitt. Munch. Ent. ges. xii. pp. 50-2, figs. 3-7 (1922); Lestage, Bull. Ann. Soc. Ent. Belg. xii. pp. 385-6 (1925).

Paduniella africana Martynov, Tabl. Anal. Faun. U.R.S.S. no. 13, p. 209 (1934).

Amongst a small collection of Trichoptera made in Njala, Sierra Leone, by Mr. E. Hargreaves, I found a

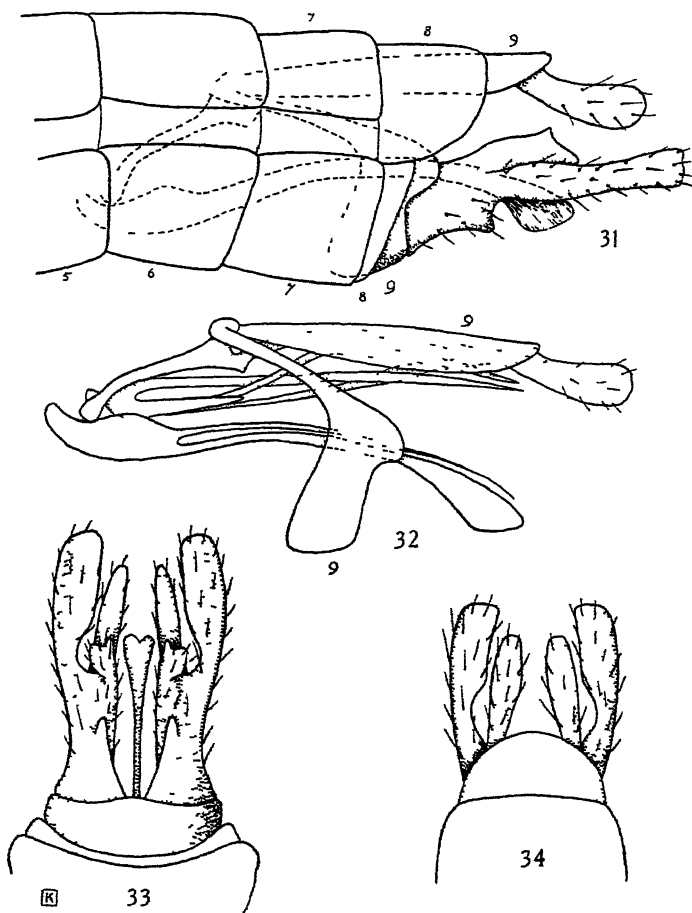


Paduniella africana Ulmer, ♂. Wings.

single example of *Paduniella africana* Ulm., which has enabled me to give further figures of this interesting little insect and, more particularly, further details of the male genitalia.

Genitalia, ♂.—Ninth tergite slightly produced beyond the margin of the eighth, narrow from the side, broad and rounded from above; beyond this is a pair of processes, simulating superior appendages, but, in a transparent preparation, connected with the penis, the base of which is seated far back in the fifth segment. These processes are no doubt an upper penis-cover, in spite of their extreme dorsal situation; penis with a dilated and excised

apex as seen from beneath, dilated on its lower margin from the side ; two very slender and long sheaths, of which only the extreme tip may be seen (under the microscope)



Paduniella africana Ulmer, ♂.

Fig. 31.—Genitalia, lateral view.

Fig. 32.—Ditto, internal structures, lateral view.

Fig. 33.—Penis, upper penis-cover, and inferior appendages, ventral.

Fig. 34.—Genitalia, dorsal view, penis and sheaths omitted.

from above ; inferior appendages long, distal portion from the side, slender, with truncate apex, basal portion

with a short branch on the inner side ; this branch has a truncate apex, with the inner angle slightly produced ; there is a right-angled excision along the lower margin ; from beneath, the distal portion of the appendage is broad, with a wide rounded excision towards the centre of its inner margin, from beneath, the lower angles of the right-angled excision appear as small processes.

Length of anterior wing, ♂, 2 mm.

Psychomyiellodes tropicus Ulm.

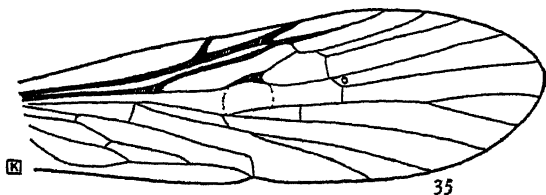
Ecnomus tropicus Ulmer, Ann. Soc. Ent. Belg. xlix. p. 35, figs. 23, 24 (1905); Gen. Insect. fasc. 60 a, p. 190 (1907); Deutsche Zent. Afr. Exp. iv, pp. 90-1, figs. 12-14 (1912); Lestage, Bull. Ann. Ent. Soc. Belg. lxxv. p. 374 (1925).

In a small collection of Trichoptera recently sent to the Imperial Institute of Entomology, London, from Sierra Leone by Mr. E. Hargreaves, I found a few examples of a species which I had no difficulty in determining as *Ecnomus tropicus* Ulm., thanks to Dr. Ulmer's excellent figures of the genitalia. Later, I had occasion to make a preparation of a male and found that in the posterior leg, the inner spur was specialised, and formed after the manner of that in *Psychomyiellodes unguolata* Mosely; the species must therefore be transferred to *Psychomyiellodes*. In the anterior wing of *tropicus*, fork 1 is present, but absent in *ungulata*.

Family Philopotamidæ.

Chimarrha intexta Mosely. (Fig. 35.)

Chimarrha intexta Mosely, Trans. Ent. Soc. Lond. lxxix. p. 547 (1931).



Chimarrha intexta Mosely, ♂. Anterior wing.

In the original description of this species, the figure of the anterior wing is slightly incorrect. The wing is accordingly refigured here.

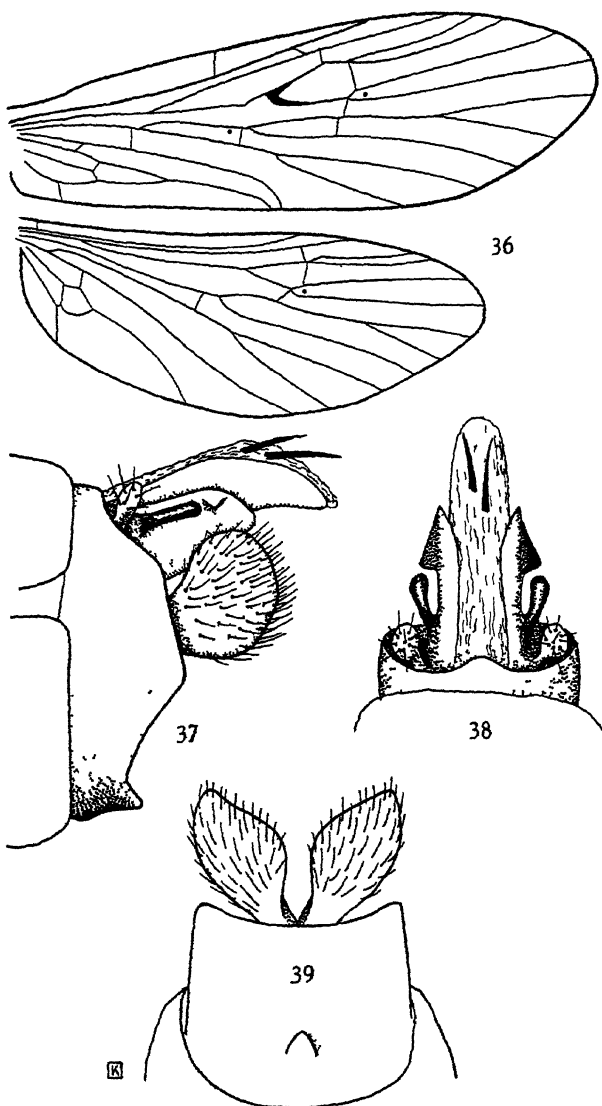


Fig. 35.—*Chamarrha cara*, sp. n., ♂.

Fig 36 —Wings.

Fig 37 —Genitalia, lateral view.

Fig 38 —Ditto, dorsal view, inferior appendages omitted.

Fig 39 —Ditto, inferior appendages etc, ventral view.

Chimarrha cara, sp. n. (Figs. 36-39.)

Every part of the insect is uniformly black; discoidal cell in both wings short and broad, fork no. 1 very narrow, its acute base meeting, or all but meeting, the nervure closing the discoidal cell; this applies to both wings; in the anterior, the sub-costa joins the costa on the distal side of the discoidal cell.

Genitalia, ♂.—Ninth segment slightly produced at the centre of its dorsal margin; from the side, broadly triangular, with the apical angle truncated; superior appendages from above, rounded and on slender foot-stalks; from the side, ovate; intermediate appendages strongly chitinated, slender, with clavate apices; from the side, stick-like; they appear to be attached to the sides of the lower penis-cover; penis long, much exerted in all examples and with two short straight spines towards the apex on the dorsal surface; lower penis-cover sleeve-shaped; from above, with triangular lateral projections towards the apex; the upper edges terminate in membranous plates which tend to cover in the upper surface of the penis; inferior appendages from the side broad, short, and rounded; from beneath, leaf-shaped, with slender bases; a blunt triangular process to the ninth ventral segment.

Length of anterior wing, ♂ 8 mm., ♀ 10 mm.

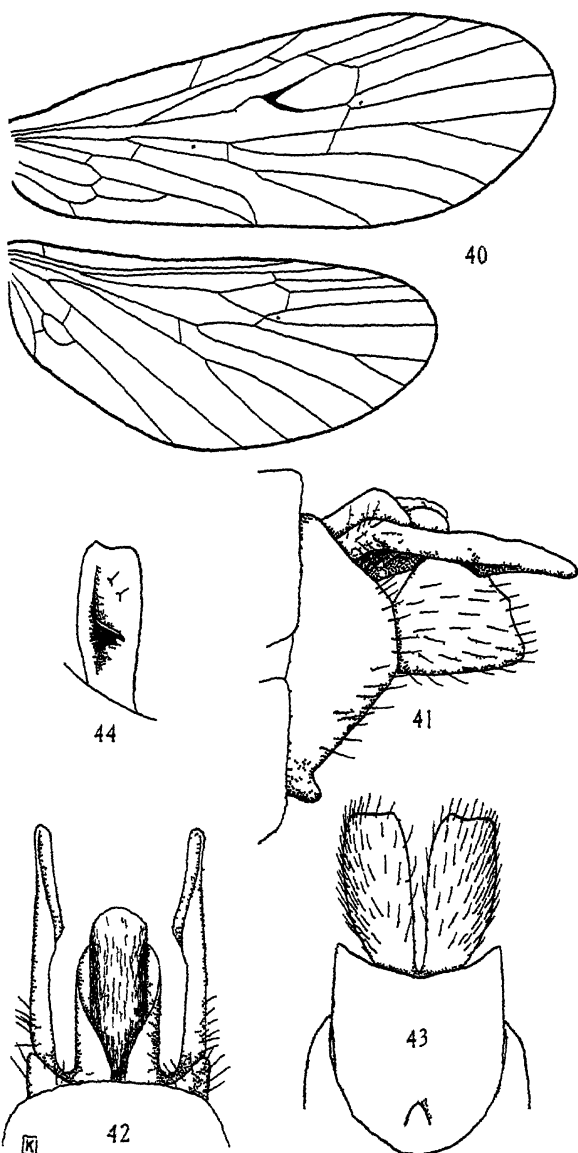
Mt. Cameroon, Musake, 6350 ft., 8-9. i. 1932 (*M. Steele*).

Type, ♂, mounted in balsam, in the collection of the British Museum. *Paratypes* ♂ and ♀ from the same locality and between the same dates.

Chimarrha leta, sp. n. (Figs. 40-44.)

General appearance uniformly black as in *cara*. Discoidal cell in both wings short and broad, and also in both wings, fork no. 1 with its base oblique and overlapping the discoidal cell; in the anterior wing, the sub-costa meets the costa at a point about opposite the middle of the discoidal cell.

Genitalia, ♂.—Ninth segment from the side, bluntly triangular; no superior appendages; intermediate appendages very long, lower margins turned inwards, so that each appendage becomes a narrow scoop with triangular



Chumarrha leta, sp. n., ♂.

- Fig. 40.—Wings
 Fig. 41.—Genitalia, lateral view.
 Fig. 42.—Ditto, dorsal view, inferior appendages omitted.
 Fig. 43.—Inferior appendages etc., ventral view.
 Fig. 44.—An inferior appendage, dorsal view.

projections of the margins towards the apex; penis large and fleshy, no dorsal spines; lower penis-cover sleeve-shaped, overlapping the base of the penis on its dorsal surface; inferior appendages from the side, triangular, joined to the segment at the apex of the triangle, upper margins produced at their centres in strong, incurving, bifid, blackened hooks; from beneath, rather long with truncate apices; a short broadly triangular process to the ninth ventral segment, the apical margin of which is concave.

Length of anterior wing, ♂, 6.5 mm.

Mt. Cameroon: Musake, 6350 ft., 8-10. i. 1932 (*M. Steele*).

Type, ♂, and *paratypes*, ♂, in the collection of the British Museum, the type mounted in balsam.

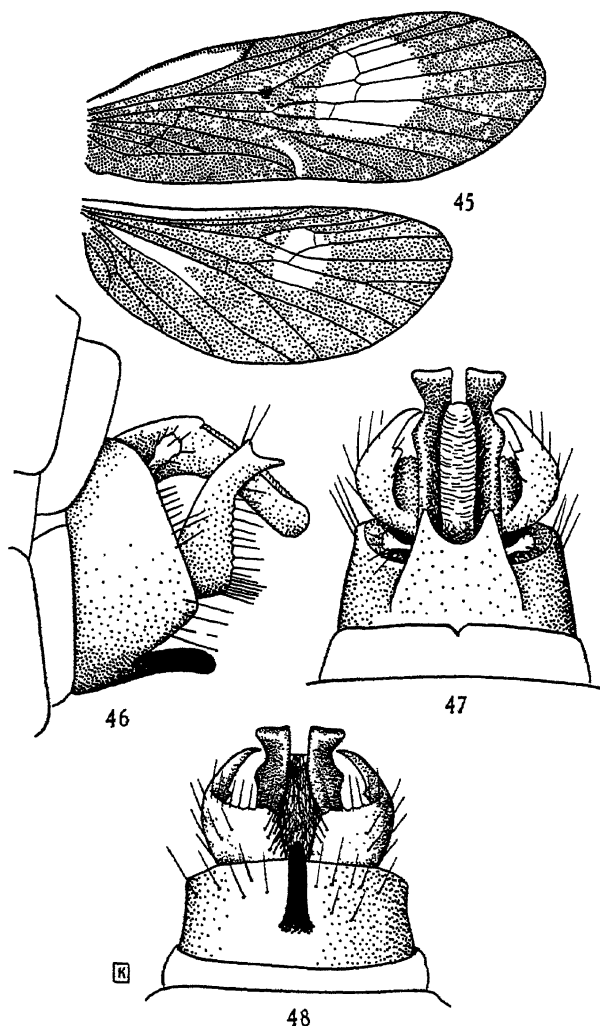
Chimarrha tamsi, sp. n. (Figs. 45-48.)

Head and basal joints of the antennæ densely clothed with orange hairs, remaining joints of the antennæ dark fuscous, nearly black; oculi black; palpi dark fuscous; femora golden-brown, tibiæ and tarsi dark fuscous; wings castaneous, both anterior and posterior clothed with short fuscous pubescence, each with a large rounded white patch and other small white patches as indicated in fig 45.

Genitalia, ♂.—Margin of the eighth dorsal segment with a small excision at the centre; superior appendages very small, extending laterally, somewhat clavate with narrow stems; there is a long, bifid, upper penis-cover, the branches arising from acute, triangular, apical projections of a broad base, and terminating in wide truncate apices; from above is seen a bluntly angular projection on the outer margin of each branch towards its apex; between the two branches is the membranous apical portion of the penis at the base of which are two straight dark penis-sheaths, one longer than the other, only visible in a cleared preparation; inferior appendages very broad at the base, from the side, lower margin serrate; apex truncate, somewhat excised, with the lower apical angle strongly produced; from above, claw-shaped; there is a straight, strongly chitinated, and rather long process arising from the centre of the ninth ventral segment.

Length of anterior wing, ♂, 7 mm.

W. Africa : São Thomé Isl., 3-20. xi. 1932 (*W. H. T. Tams*).



Chimarrha tamsi, sp. n., ♂.

Fig. 45.—Wings.

Fig. 46.—Genitalia, lateral view.

Fig. 47.—Ditto, dorsal view.

Fig. 48.—Ditto, ventral view.

Type, ♂, and *paratypes*, ♂ and ♀, in the British Museum collection.

XLIV.—*The Arctic Species of Molpadia (Holothuroidea), and some Remarks on Heding's Attempt to subdivide the Genus.* By ELISABETH DEICHMANN, Museum of Comparative Zoology, Harvard College, Cambridge, Massachusetts.

THE question, how many species of *Molpadia* do actually inhabit the Arctic Seas, is closely linked up with the question whether the presence or absence of the peculiar anchors and racquet-shaped plates in the skin represents a generic difference or not.

Clark (1908) was the first to study the gradual disappearance of these spicules in the common *Molpadia intermedia* Ludwig from the Pacific Ocean, and he also made the shrewd observation that the *Ankyrodermas* usually remain small while the *Trochostomas*, on the other hand, never are taken when they are young. He therefore concluded that anchors and racquet-shaped plates are juvenile characters, and, although they may be preserved throughout the whole life in certain species and possibly never occur in other forms, they do not constitute practical reliable characters. *Ankyroderma* and *Trochostoma* were therefore relegated to the synonyms of *Molpadia*.

Hérourard (1910, 1923) realized fully that the anchors and racquet-shaped plates grew more scarce in older individuals, and when once lost they were not replaced, and he gave the very plausible explanation that, when an anchor was broken, through outer injury, the rosette of racquet-shaped plates degenerated, became reddish in colour, and disintegrated into phosphatic bodies. Therefore, the anchors and racquet-shaped plates would be most likely to occur near the oral and anal ends only, in older individuals, as they here were less exposed than on the middle of the body. This explanation may give the clue to the irregularity with which these spicules disappear, for very likely a specimen living on very soft bottom may retain its anchors intact for a longer period than one which lives in gritty sandy mud.

Except for his postulate that some anchors and racquet-shaped plates usually remain in the skin, Hérourard gives very little evidence of the differences existing between

the five Arctic species of Molpadids which he recognizes. The calcareous deposits seem strikingly alike, and it is also noteworthy that his specimens with anchors all came from the same localities as his specimens without these spicules.

Heding (1935) endorses Hérouard's view-point, and maintains that there are five Arctic species. Also in his material it is remarkable how the distribution of the *Ankyrodermas* coincides with that of his *Trochostoma thomsonii*. He gives, unfortunately, no chart of the distribution of the species of *Ankyroderma*. On the chart of the distribution of the three species of *Trochostoma* he omits the type-locality of *borealis* Sars, thus creating the impression that this species only occurs in the Kara Sea, which is the one locality where it probably does not occur. (Heding's specimens of *borealis* from Kara Sea are undoubtedly *M. arctica* (v. Marenzeller), whereas his records of the latter species from East Greenland may refer to *borealis*.)

The spicules of the five "species" are very much alike, as a glance at Hérouard's and Heding's figures will show. Heding's figures of the spicules from the tail region show particularly well the similarity in shape which exists between those from the species of *Ankyroderma* and those from the southern species of *Trochostoma*, which occur in the same localities.

The much discussed difference between the calcareous rings in the two "genera" is well illustrated by Heding on pl. v. Figs. 14-16 represent the calcareous ring of the two species and a variety of *Ankyroderma*. They are very alike and show some similarity to fig. 5, which represents the ring of an aged *Trochostoma thomsonii*. On the other hand, figs. 1-5, which all represent *T. thomsonii*, show considerable variation. Unfortunately, no figure is given of the calcareous ring of a young *T. arctica* or *thomsonii*; only rings from large specimens have been figured.

A study of the literature pertaining to these species, especially of the original papers of Sars, and Danielssen and Koren, gave the impression that there is nothing to prove that there is more than one widespread species, possibly divided into a northern and southern form. Only one thing was evident, anchors and racquet-shaped

plates were never reported in the skin of any specimen collected in the Kara Sea and vicinity, whereas in the Northern Atlantic (including the waters around North Cape and Spitzbergen), specimens with these deposits were frequently found in the same localities as the specimens which lacked these deposits.

Finally, I succeeded in finding two complete series of Arctic Molpadids from two widely separated localities, with individuals ranging in size from 1-6 cm., in the Zoological Museum in Amsterdam. One of these series, from Kara Sea, showed no trace of anchors and racquet-shaped plates, while the other, from W. Barentz Sea, showed the greatest diversity in the number of these spicules. Moreover, the two series showed a constant difference in the spicules of the tail-region, viz., irregular star-shaped tables in the form from Kara Sea, and more or less slender fusiform tables or rods in the W. Barentz Sea species. And these differences are in agreement with what Heding figures for his specimens from Kara Sea and what Sars, Danielssen and Koren, and Heding have figured for the various species occurring in the northern Atlantic Ocean.

The conclusion has therefore been reached that there are two distinct species, and only two, in the Arctic region and northern Atlantic, and they occur in distinct areas which, so far as our present knowledge goes, do not overlap.

I beg the Director of the Zoological Museum in Amsterdam, Dr. de Beaufort, to accept my thanks for permission to study this unique material. Also I feel much indebted to Dr. Engel of the same Institute for the great patience with which he went over the material and independently checked my results.

*Key to the Species of Molpadia from the Arctic Seas
and the Northern Atlantic.*

Spicules in tail, fusiform tables or rods with four central holes. (Anchors and racquet-shaped plates present in young individuals. Tables in body-wall predominatingly regular with three large holes, although irregular forms may also appear. Calcareous ring with a circular to oval depression for the lower part of the tentacle ampullae, indistinct in older individuals.).....

[Sars.
Molpadia borealis

Spicules in tail, star-shaped or irregular tables with numerous perforations. (Anchors and racquet-shaped plates completely absent. Tables in body-wall with great tendency to be irregular, often the holes are imperfectly closed, although a number seem to be regular, with three large holes. Calcareous ring with undivided depression for the tentacle ampullæ.) [(v. Marenzeller). *Molpadia arctica*]

Remarks.—The two species seem to reach the same size, about 15 cm. in length, rarely 20. The number of digits is probably the same and the statements to the contrary seem at variance. The presence or absence of phosphatic bodies is not of importance, as they occur in both species, although the majority of the specimens of *arctica* are almost without them. The spicules are of approximately the same shape and type, perhaps a little stouter and more irregular in *arctica*. The inner anatomy is almost identical in the two forms. The differences in the attachment of the mesenteries, as Heding figures them (1935, pl. viii.), show as much variation within the same "species" as between different "genera." The calcareous ring may be different in the two species, but whether this character will be of practical value or not will have to be proved. (I did not examine the ring in the small individuals I had in Amsterdam, and Heding gives no figure of the ring of the young individuals from Kara Sea.) In the old individuals the rings are fairly alike. The tendency to reduction of the ventral prolongation of the ring is pronounced in some of the large specimens of *arctica*, but not in all, and very likely it is just as characteristic of *borealis*. It does not appear in the "species" of *Ankyroderma*, simply because they represent the younger stages where this senile reduction has not yet set in.

Molpadia borealis Sars. (Figs. 4-6.)

Molpadia boreale Sars, 1858 (diagnosis); 1861, p. 116, pls. xii.-xiii.; ? Murdock, 1885, p. 157.

Trochostoma boreale Ludwig, 1900, p. 161; Mortensen, 1903, p. 89.

Ankyroderma jeffreysii Danielssen & Koren, 1879, pp. 128, 135, pls. v.-vi. figs. 11-19; Ludwig, 1900, p. 162; Heding, 1935, p. 45, pl. iii. fig. 19, pl. iv. figs. 7-8, pl. v. fig. 14, pl. vii. fig. 4, pl. viii. fig. 5.

Molpadia jeffreysii Hérouard, 1923, p. 130, pl. ix. fig. 11.

Molpadia jeffreysii var. *gracilis* Hérouard, 1923, p. 131, pl. ix. fig. 12.

Ankyroderma affine Danielssen & Koren, 1879, p. 133, pls. v.-vi. figs. 22-28; Heding, 1935, p. 47, pl. iv. fig. 12, pl. v. figs. 15-16, pl. viii. figs. 6-7.

Trochostoma thomsonii Danielssen & Koren, 1879, p. 229, pls. i.-iii.;

Hérouard, 1923, p. 133, pl. viii. figs. 4-6; Mortensen, 1932, p. 41;

Heding, 1935, p. 52, pl. iv. figs. 1-6, pl. v. figs. 1-5, pl. viii. fig. 1.

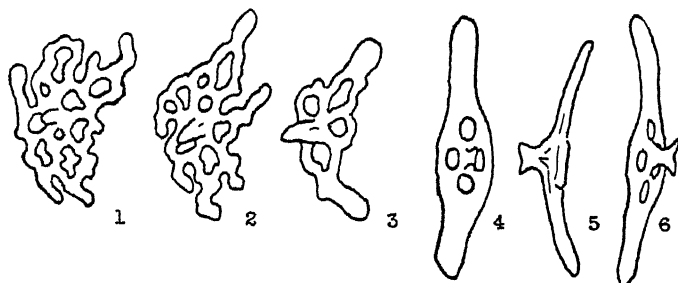
Molpadia arctica Mortensen, 1910, p. 283 (partim).

Molpadia blakei var. *grœnlandica* Mortensen, 1910, p. 285.

Molpadia oolitica Mortensen, 1914, p. 320.

Non *Molpadia borealis* Pourtales, 1869, p. 360 * (= *oolitica* Pourtales).

Diagnosis.—Large Molpadids with tables in the body-wall, mostly with three large holes, occasionally not closed, and a solid spire. Tail with fusiform tables or rods with four central perforations, rarely irregular. Anchors and racquet-shaped plates numerous in young individuals, but rarely present in the larger ones; phosphatic bodies often numerous; in young individuals a green pigment may sometimes be present.



Figs. 1-3.—Irregular tables from the tail-region of *Molpadia arctica* (v. Marenzeller) from Kara Sea. Length 4 cm.

Figs. 4-6.—Fusiform tables from the tail-region of *Molpadia borealis* Sars from W. Barentz Sea. Length 4 cm.

(Scale 0.01 mm.)

Type.—Zoological Museum, Oslo.

Type-locality.—Oxfjord, Finmarken.

Distribution.—Ranging from off the northern coast of Norway, including Finmarken (Sars, Danielssen and

* Pourtales identified a specimen from off Florida as *borealis*, actually it represented his own *oolitica*, collected earlier from off Massachusetts. Selenka corrected this, but Ludwig, overlooking the first record of *oolitica*, listed *borealis* from Florida as identical with the true Arctic *borealis* Sars, and placed *oolitica* as a synonym, and Clark substituted *borealis* with the older name *oolitica*, although he felt that it was very unlikely that the Arctic species actually occurred in West Indian waters. *M. oolitica* seems to be restricted to the western part of the temperate Atlantic, and is entirely different from the Arctic *borealis*.

Koren), Spitzbergen (Ludwig), between the west coast of Norway (Danielssen and Koren) and Iceland (Hérouard, Heding), east coast of Greenland (Mortensen, identified by Heding (1935) as *affine* and *arctica*), west coast of Greenland (Mortensen), Baffins Bay (Mortensen). Not known from any locality off the east coast of the North American continent, but Murdock's record from Point Barrow, Alaska, may refer to this species.

Depth.—From about 125 to 500 fms., rarely deeper. In the arctic region it seems to occur in shallower water; in the Atlantic Ocean it follows the area limited by the 300 and the 600 fm. line, as Heding's chart shows.

Specimens examined.—About a dozen specimens from W. Barentz Sea, ranging in size from 1–6 cm. (in the Zoological Museum in Amsterdam).

Remarks.—The specimens in Amsterdam show to perfection the variation in the number of anchors and racquet-shaped plates and their gradual disappearance in individuals of 4–5 cm. length—one individual which measured 1 cm. in length had only one anchor left. Also the variation of the spicules in specimens from the same locality is well illustrated. Hérouard (1923) and Heding (1935) show a similar range of variation in their figures. In one small individual was found the greenish pigment (instead of phosphatic bodies) which Danielssen and Koren described in their *Ankyroderma affine*.

Danielssen and Koren's types of *A. jeffreysii* were in two cases taken with their specimens of *T. arcticum*, viz., from Porsanger and Tana Fjord, northern Norway, and the types of *affine* and *thomsonii* came both from the west coast of Norway, between 62°–72° N. lat. and 1°–20° E. long. Hérouard's material came from between Norway and Iceland, and in all cases smaller individuals, with anchors, were captured in the same hauls as the large specimens which lacked these deposits. Ludwig's material from Spitzbergen included specimens with and without anchors and in some cases they came from the same localities. Heding reports *T. thomsonii* from between the Færoes and north-east of Iceland, also in some cases taken with his *A. affine* and *jeffreysii*.

From the east coast of Greenland, Mortensen (1903, p. 89) reported some Molpadids as *T. boreale*. Later (1910, p. 285) he divided this material between *M. arctica*

and *M. blakei* var. *grœnlandica*. Hérourard (1923, p. 132) correctly pointed out that the latter variety is undoubtedly closely related to *A. jeffreysii*, whereas the true *M. blakei* is known only from the West Indies. In 1914 Mortensen gave the first record of *Molpadia* from the west coast of Greenland as *M. oolitica* (being under the impression that *borealis* and *oolitica* were identical). In 1932 (p. 41) he reported the first Molpadid from Baffins Bay and called it *thomsonii* (on Heding's authority). Heding (1935) refers the East Greenland specimens to *T. arctica* and *A. affine*; at one station they were both taken in the same haul (Fleming inlet).

From the close similarity in the shape of the spicules of all these forms, as figured by Hérourard and by Heding, it seems quite evident that these specimens all belong to one species which has anchors and racquet-shaped plates in the skin while it is young, and has fusiform tables in the tail. Its geographic distribution offers nothing unusual. It occurs widespread in the North Atlantic Ocean, ranging from east of Spitzbergen, off the north and west coast of Norway, across the Atlantic, along the northern side of the Wyville-Thomson Ridge (with surprising accuracy following the area limited by the 300 and 600 fathoms bathymetric lines) as shown in Heding's chart (1935, p. 57). To the distribution indicated by him must be added Sars's record of *boreale* and Danielssen and Koren's record of "*arctica*" from northern Norway, and Ludwig's *boreale* and *jeffreysii*, from near Spitzbergen (apparently designated as *arctica* on Heding's chart). The records from East Greenland may refer to *arctica* as Heding thinks, but most likely they are *borealis*. The records from West Greenland and Baffins Bay lack, strictly speaking, still the evidence of the *Ankyroderma*-stage (which is characteristic of most other localities in the northern Atlantic), but Heding refers this material to his widespread *T. thomsonii* (here considered the senescent stage of *borealis*).

Molpadia arctica (v. Marenzeller). (Figs. 1-3.)

Haplodactyla arctica v. Marenzeller, 1877, p. 29, pl. iv. fig. 1; Clark, 1908, p. 169; Hérourard 1923, p. 134, pl. viii. fig. 1; Heding, 1935, p. 58, pl. v. fig. 8, pl. viii. fig. 2, text-fig. 15.

Trochostoma boreale Levisen, 1886, p. 388 (partim); Heding, 1935, p. 60, pl. v. figs. 6-7, pl. viii. fig. 3, text-fig. 16.

Non *Trochostoma arctica* Danielssen & Koren, 1879, p. 126.

Diagnosis.—Large Molpadids with numerous tables in the body-wall, as tables with mostly three holes frequently not closed or developed as bifurcating rods; spire solid, composed of three rods which have fused. Tail with tables of irregular shape, disk star-shaped or oblong, with numerous holes. Anchors and racquet-shaped bodies seem to be lacking even in the smallest specimens (1 cm.). Phosphatic bodies absent or scarce in most cases, but occasionally numerous.

Type.—Probably in Vienna.

Type-locality.—North of Nova Zembla.

Distribution.—Probably restricted to the Kara Sea and adjacent waters. (Danielssen and Koren's specimen of *arctica* came from the same localities as their *A. jeffreysii*, and their description suggests an aged *M. borealis* Sars.) Heding's specimens from East Greenland, in one case taken with *A. affine*, seem more likely to be also *borealis*, as is evident from his remarks (p. 60), that "*T. arcticum* is most closely related to *T. thomsonii* . . . probably synonymous."

Depth.—From 20 to 105 fms. (Levinsen's records). Most authors give no exact depth.

Specimens examined.—About 30 in the Museum in Amsterdam, all from Kara Sea and ranging in size from 1-15 cm. Also three large ones in the M. C. Z., same region ('Dijmphna'-Expedition).

Remarks.—The species is evidently much more restricted in its distribution than *borealis*, and the material in Amsterdam seems to prove definitely that it never possesses anchors and racquet-shaped plates as the latter does. The type and the majority of the individuals examined lack phosphatic bodies, but in the material in the M. C. Z. two specimens are distinctly "freckled" with phosphatic bodies, while a third is thickly covered by them. The spicules resemble those found in *borealis*, but show more tendency to be irregular, and seem also to be more numerous. Those in the tail are distinctly different. The calcareous ring may show definite differences; it is regrettable that Heding, who examined a number of small individuals from Kara Sea, did not figure the calcareous ring of a young individual. His specimens of *borealis*, also from Kara Sea, are undoubtedly poorly preserved specimens of *arctica*. (The identification

is due to Levinsen, who held that all the arctic *Molpadids* belonged to one species and naturally used the oldest name, *borealis*, for the material which he examined.)

In this connection a few words may be added about Heding's recent attempt (1931, 1935) to subdivide the genus *Molpadia* Cuvier as it has been re-defined by Clark (1908). Desirable as it would be to have the different species arranged in natural groups, our knowledge is still too imperfect to make such an arrangement more than guesswork. Heding pays much attention to the shape of the calcareous ring, and considers it, together with the presence or absence of anchors and racquet-shaped plates, a character of sufficient importance to constitute generic divisions. It is true that the calcareous ring in some species have perforations or notches for the nerves which the other forms lack, but these species have also spicules of a characteristic type, save for the absence in some of them of the anchors and racquet-shaped plates. In the other "genera" the calcareous ring is of a rather uniform type, and the alleged differences may be due to age or individual diversity, or they simply do not exist. The presence or absence of anchors and racquet-shaped plates, which Heding thinks corresponds with the type of the calcareous ring, is of doubtful value, as we know surely that these deposits disappear in certain species, whereas other species are known only from large senescent individuals which, from the shape of their other spicules, may be suspected of having had anchors and racquet-shaped plates when they were young.

Molpadia.—In this genus Heding places *M. musculus* and allied forms. It is a very natural group, but *M. maroccana* Perrier does not belong here. Its calcareous ring (well figured by Perrier, 1901, pl. xxii. fig. 15) lacks the nerve perforations and resembles Heding's figures for his two new species, *diploa* and *capensis* (1935, pl. v. figs. 11, 12), placed in a new subgenus, *Paramolpadia* (1931, p. 279; 1935, p. 39). Moreover, the spicules of *maroccana*, *diploa*, and *capensis* show such striking similarity (Perrier, 1901, pl. xxii. figs. 9-14; Heding, 1935, text-figs. 7, 8) that most investigators will not hesitate to unite them. The geographic distribution does not contradict this assumption, as all three species are taken from deeper water in the eastern part of the Atlantic

Ocean, viz., from south of Iceland, west of Marocco, and off the Cape of Good Hope.

Pseudomolpadia Heding, 1931, p. 280.—The diagnosis of this genus reads:—"Ankyroderma-like Molpadids, which have the anchors either united with a single fenestrated plate, or supplied with more than two arms." (The diagnosis is compiled from Clark's key, 1908, p. 160.) It must, however, be noted that it is only in *tridens* (Sluiter) and *marenzelleri* (Théel) that the racquet-shaped plates are definitely known to be "not united in rosettes." Koehler and Vaney do not state anything about the arrangement of the racquet-shaped plates in their two species *brevicaudata* (and *contorta*), merely that they resemble in shape those found in *tridens*. Clark made the mistake of assuming that the racquets were isolated, but there is no reason for repeating this error. In *M. inflata* (Augustin) the racquet-shaped plates form typical rosettes (although the anchor itself was found lying isolated in the skin (Augustin, 1910, p. 33)). The only species, known to have anchors with more than two arms is *polymorpha* (Koehler & Vaney), which Heding has omitted from his list.

Haplodactyla Grube, 1840.—Heding's use of this old name must be condemned, both the use he made in 1931 and that he makes in 1935. In his preliminary account he re-established *Haplodactyla*, with *H. mediterranea* Grube as the type-species; the diagnosis given is based upon his new species *asaphes*. In 1935 he makes *asaphes* the type-species of a new genus *Eumolpadia*, and uses the name *Haplodactyla* for the species hitherto called *Caudina albicans* Théel. His reasoning is, that Baldelli's *Trochostoma mediterranea* (at utmost a variety of *albicans* Théel) is the only other Molpadid which is known from the Mediterranean Sea. It would, however, be almost miraculous, if Grube should have succeeded in capturing a typical deep-water form (Baldelli's specimen came from 800-1000 metres depth—most specimens of *albicans* from other localities are taken from even greater depth), in 1840, where most dredgings were restricted to 200 metres or less. Moreover, Grube informed (1850) J. Müller that he later got a specimen of *H. mediterranea* from near Palermo and examined the spicules, which were "spießige und nadelförmige," which agrees perfectly well with

M. musculus, frequently secured at 70–200 metres in the Mediterranean Sea, but not with *albicans*. Ludwig discussed the whole question carefully in 1891, and there is absolutely no reason for re-establishing *Haplodactyla*.

Eumolpadia Heding, 1935, p. 41, new name for *Haplodactyla* Heding, 1931. The type-species *asaphes* Heding has spicules which resemble those of *M. violacea* (Studer) in general type. The calcareous ring shows in both forms the perforations for the nerves, which also characterizes *M. musculus* and allied forms (*violacea* has hitherto been regarded as a specimen of *musculus* in which the anchors and racquet-shaped plates have disappeared). It would therefore be more appropriate if *Eumolpadia* was regarded as a subgenus of Heding's *Molpadia* (and probably identical with it), differing merely in the absence of anchors and racquet-shaped plates.

The third species which Heding places in *Eumolpadia* is *M. intermedia* (Ludwig). The species was described in 1894 as *Trochostoma*, but Ludwig described and figured a single racquet-shaped plate from the type, and Clark, who later had occasion to examine the type and hundreds of other specimens, found that the young individuals had numerous anchors and racquet-shaped plates, but that they disappeared more or less completely and were extremely rare in the larger individuals. The other spicules in *intermedia* (a common form in the eastern Pacific Ocean) are three-pillared tables, resembling those of *M. oolitica* Pourtales, from the western temperate Atlantic, and showing the same tendency to disappearance. The long fusiform rods, which are so characteristic of the two other species of *Eumolpadia*, are entirely lacking; the calcareous ring has never been figured.

Ankyroderma and *Trochostoma*.—The two genera are, according to Heding, 1931, rather alike, but differ in the shape of the calcareous ring, which is more deeply sculptured in *Ankyroderma*, and in the presence of anchors and racquet-shaped plates in *Ankyroderma*. Hozawa's study of the calcareous ring in a single species of a related genus, *Cardina chilensis*, from Japan, shows how unreliable such characters as deeply sculptured or faintly sculptured are. Moreover, the length of the ventral prolongations on the ring are subject to change with

age. Heding's own figures of the calcareous ring of *Ankyroderma* and *Trochostoma* (1935, pl. v. figs. 14-16, 1-5) show how the clean-cut, deeply hollowed depressions for the tentacle ampullæ in *Ankyroderma* are faintly indicated in his *Trochostoma thomsonii* (fig. 5). In *Trochostoma* the ventral prolongations are stated to be "often nearly rudimentary." Only in some of the most senile specimens of *M. arctica*, from Kara Sea, has this character been found pronounced, and it may be expected to appear in almost any senescent Molpadid. In case of nine species (out of the sixteen which Heding lists in 1931 under *Trochostoma*) the types have been examined by the writer, and none of them show any notable shortening of the ventral prolongations on the calcareous ring.

Our present knowledge of the species placed in the various "genera" is still too insufficient to draw the line between them, and the most natural recourse, as long as we do not know whether anchors and racquet-shaped plates occur in the earlier stages of such species as *oolitica* and *amorpha*, and possibly in many other forms, will be to retain the name *Molpadia* and arrange the species, according to the type of the spicules, into the *musculus*-group, *maroccana*-group, *intermedia*-group, *roretzii*-group, etc., until the complete life-history has been worked out, at least in a few typical cases.

NOTE.—As Heding gives no bibliography in his monograph, it has been necessary to quote the papers which have appeared since Clark's monograph (1908), to which the reader is referred for earlier references.

REFERENCES.

- AUGUSTIN, E. "Ueber Japanische Seewalzen." Abhandl. Math.-Phys. Kl. Bayer. Akad. Wissensch. suppl. 2, art. 1, pp. 1-44, pls. i.-ii. Munich, 1908.
- CLARK, H. L. "The Apodous Holothurians." Smithsonian Cont. Diff. Knowledge, vol. xxxv. no. 1723, pp. 1-231, pls. i.-xiii. Washington, 1908.
- HEDING, S. "On the Classification of the *Molpadia*." Vid. Med. Dan. Nat. For. vol. xcii. pp. 275-284. Copenhagen, 1931.
- . "Holothuriodea.—Part I." The Danish Ingolf Exped. vol. iv. pt. ix. pp. 1-84, pls. i.-viii. text-figs. 1-20, 1 chart. Copenhagen, 1935.
- HÉROUARD, E. "Sur les Molpadides de Norvège." Bull. Inst. Ocean. Monaco, no. 177, pp. 1-10, text-figs. Monaco, 1910.
- . "Holothurios." Res. Camp. Sci. Prince de Monaco, fasc. 66, pp. 1-161, pls. i.-x. Monaco, 1923.

- HOZAWA, S. "On the Changes occurring with Advancing Age in the Calcareous Deposits of *Caudina chilensis* (J. Müller)." Sci. Rep. Tohoku Univ. ser. 4, Biol. no. 3, pp. 301-378, pls. xiv.-xvii. Sendai, Japan, 1928.
- MORTENSEN, TH. Medd. Grönland, vol. xxix. pp. 63-89, pls. i.-ii. 1903; *ibid.* vol. xlv. art. 4, pp. 237-303, 1910; *ibid.* vol. xxiii. pt. ii. pp. 317-347, 1914; *ibid.* vol. lxxix. no. 2, pp. 1-62, pl. i. 1932. Copenhagen.

XLV.—*Mammals from Angola, including a new Species of Claviglis and a new Race of Zelotomys.* By JANE ST. LEGER, F.Z.S. From the Department of Zoology, British Museum (Natural History).

DR. MONARD, of the Musée d'Histoire Naturelle, Chaux-de-Fonds, Switzerland, succeeded in making a very interesting collection of mammals in Angola during two short visits there in the years 1929 and 1932. Of these mammals he has already described several new forms (Bull. Soc. Neuchatel. Sci. Nat. liv. (new series, vol. iii.), 1929, and lvii. 1932), but a few specimens, owing to the lack of material with which to compare them, Dr. Monard was unable to determine satisfactorily. These have been sent to the British Museum, where I have had the pleasure of examining them. Amongst them is a dormouse and a small rat of the rare genus *Zelotomys*, both of which prove to be new forms. The dormouse is of unusual size, larger than any known race with the single exception of *C. hueti* from the Gold Coast and Cameroons. The specimen of *Zelotomys* is the first indication of the presence of this genus in south-western Africa; hitherto it has been recorded only from East Africa and Northern Rhodesia.

Dr. Monard has generously presented to the British Museum collection the types of the new species of *Claviglis* and of the new subspecies of *Zelotomys*, as well as examples of most of the other species and races mentioned in this paper.

A few explanations are necessary as regards localities. For these I have followed the phonetical spellings adopted by Dr. Monard in his papers cited above on the results of his expeditions. Tyihumbwe River is the phonetical spelling of Chiumbe River, and the specimens were obtained at a point near the source of the river (approximately 11° South and 20° East). Kuvangu

River=Kubangu River, and the majority of specimens labelled Kubangu or Kuvangu River were obtained near Vila-da-Ponte, Mossamedes.

Unfortunately the labels of some of the specimens preserved in alcohol have been lost; these specimens were obtained either near Vila-da-Ponte or at the Tyihumbwe River.

Crocidura hirta Peters.

1 specimen in alcohol (label lost).

The range of this shrew appears to extend from Portuguese East Africa through the Rhodesias and Lower Congo to Angola.

Crocidura sp. ?

1 specimen in alcohol (label lost).

A dark-coloured shrew apparently nearly related to *C. turba angolæ* Dollm., but with white muzzle, feet, and tail. It is unfortunate that there is no record of the exact locality from which this specimen was obtained.

Claviglis parvulus Monard.

Graphiurus parvulus Monard.

2 specimens from Kuvangu River, Mossamedes.

This species is paler in colouring than either *C. angolensis* De Wint. from Caconda or *C. ansorgei* Dollm. from Dongwenna, Mossamedes. From *C. angolensis* it is further distinguished by the white feet, which are not streaked mesially with brown, as in *angolensis*. A dark eye-ring and a dark streak from eye to muzzle, in which it resembles *C. angolensis*, immediately differentiates it from *C. ansorgei*, in which species the eye-ring is only faintly marked and the dark streak from the eye to the muzzle entirely lacking. Unfortunately the skulls of these two specimens are broken, but in size and characters they appear very closely to resemble that of the type of *C. angolensis*.

Claviglis monardi, sp. n.

2 specimens from 15 km. above Dala, Tyihumbwe River.

A large dormouse approaching in point of size *C. hueti* of the Gold Coast and Gaboon, but with longer, less woolly fur, different coloration, and skull with larger bullæ and markedly smaller teeth.

Fur longer than is usual in this genus, the hairs on the rump measuring about 11 mm. in length. General colour of dorsal surface buffy brown (Ridgway, pl. xl.), darkening to chætura drab (pl. xlv.) on the crown of the head and mid-dorsal line; base of fur dark grey; face buffy brown, with a narrow dark eye-ring and a streak, wider than the eye-ring, from the eye to the muzzle; ears brown, clothed with very fine short hairs. General colour of ventral surface of type creamy, the colour fairly sharply demarcated from that of the dorsal surface; base of fur dark grey. On the chin, throat, chest, and under surface of the arms the cream-colour of the hair-tips is replaced by reddish brown. This reddish-brown colour may possibly be due to staining, as, in the cotype, the cream-colour of the hair-tips of the ventral surface is everywhere replaced by the reddish-brown colouring, the colour being deepest on the chin and throat and lightening to creamy buff on the flanks and thighs. Backs of hands and feet of type creamy, of cotype reddish brown. Tail buffy brown, with a wide border and tip of creamy white; the length of the hairs of the tail is about 40 mm., of which the creamy-white border occupies about 23 mm.

Measurements of Type.—Adult male (B.M. no. 35.3.20.1), 15 km., above Dala, Tyhumbwe River. (Taken from dried skin.) *Head and body* 160 mm.; *tail* (to tips of hairs) 130; *hind foot* 21.5.

Skull.—In general appearance the skull is not unlike that of *C. hueti*, but smaller and with a somewhat flatter brain-case, which is not so distinctly flattened, however, as in that of the subgenus *Gliriscus*. Muzzle shorter than in *C. hueti*. Bullæ much longer, but scarcely greater in height than those of *C. hueti*. Cheek-teeth remarkably small, resembling in point of size those of *Graphiurus ocularis*. The cheek-teeth of *C. monardi*, however, show the distinctive characters of the teeth of *Claviglis* as opposed to those of *Graphiurus* in that the premolar shows the same pattern, and is nearly equal in size to the molars, whereas in *Graphiurus* the premolar is a small simple tooth, distinctly less in size than the molars. Unfortunately the premolars have fallen out of the skull of the type; but one premolar is present in the skull of the cotype of *C. monardi*.

Measurements of Skull.—Greatest length 36.6 mm.; condylo-basal length 36.4; zygomatic width 27.5; greatest breadth of brain-case 16.3; greatest height of brain-case 10; least interorbital constriction 6; length from condyle to anterior border of premolar 23; length from anterior border of premolar to tip of nasals 13.6; width of choanæ 2.5; length of bullæ 12; greatest breadth of bullæ 7.6; alveolar length of upper tooth-row 4.4; breadth of m^2 1.5.

Dr. Monard informs me that the country from which this dormouse was obtained is a plateau, about 1250 m. in altitude; there is a distinctly marked wet and dry season, the period of heavy rain lasting from October to April; the country is covered with a rather thin forest of Acacias, Berlinias, etc., and several small streams fall into the Tyihumbwe River. The dormouse inhabits the forest, but is also found in cultivated fields and even in the villages of the natives.

Taterona angolæ Wroughton.

4 specimens from Tyihumbwe River. One specimen from each of the following localities: Kuvelai River, Humbi, Osi, Kamba, Kambisa. 6 specimens from Mulondo. All localities in Mossamedes.

The three skins from Tyihumbwe River are slightly darker in colour than those from Mossamedes, but the colouring of the whole series lies within the range of variation of *T. angolæ*, as proved by a series of this species from Fort Quilenga, Benguella. In the skull the incisors are noticeably more recurved (opisthodont) than in the larger species, *T. valida*, which inhabits the same territory.

Taterona valida Bocage.

2 specimens from Osi, Mossamedes.

A larger species than *T. angolæ*, with incisors frequently very faintly grooved; in these two specimens from Osi the grooving of the incisors is practically imperceptible.

Gerbillus swalius leucanthus Thomas.

1 specimen from Mupanda, Angolan-Damaraland border.

The type-locality of this pale-coloured race is Ondongwa, Central Ovamboland, some 50 miles south of Mupanda.

Thallomys herero Thomas.

1 specimen from Mupa, Mossamedes ; 3 specimens from Kuanyama ; 1 specimen from Naulila. The two latter localities are near the Angolan-Damaraland border.

Grammomys surdaster Thomas & Wroughton.

2 specimens from Tyihumbwe River.

This species appears to range from Zomba on the East Coast, through the forests of Rhodesia and South Congo, to Angola. It has been obtained at Pungo N'dongo, only some 160 miles from Loando.

Hylomyscus carillus Thomas.

1 specimen from Tyihumbwe River.

Rhabdomys pumilio angolæ Wroughton.

1 specimen from Caluquembe, Benguela ; 1 specimen (juv.) from Tyihumbwe River.

The type-locality of this subspecies is Caconda, about 50km. west of Caluquembe. The skin listed above from this locality is unusually light in colour, whilst the skin from Tyihumbwe is very dark and matches a skin of *R. angolæ* (Nazaroff) from Munhango, Angola. Another skin (Nazaroff) from Munhango shows an intermediate stage ; the shoulders and flanks are as light in colour as those of skins of the typical series from Caconda, whilst the remainder of the dorsal surface is nearly as dark in colour as the skin from Tyihumbwe listed above ; the ventral surface is parti-coloured, the hairs of the pectoral region being dark grey throughout, whilst those of the inguinal region are tipped with deep cream-colour.

Comparison of these skins with other specimens proves that this darkening of colour is not due to age ; rather, it seems that the genus *Rhabdomys* is unusually prone to show melanism.

Lemniscomys griselda Thomas.

1 specimen from Osi, Mossamedes.

Lemniscomys griselda sabulata Thomas.

1 specimen from Mupanda, near the Angolan-Damara-land border.

The skin of this specimen is very grey in colour, quite distinct from the skin of *L. griselda* listed above from the more northern locality of Osi.

Pelomys frater Thomas.

3 specimens from Tyihumbwe River; 1 specimen from Ebanga; 1 specimen from Bimbi, Benguella.

Dasymys nudipes Peters.

1 specimen (juv.) from Tyihumbwe River.

Mastomys coucha Smith.

1 specimen from Tyihumbwe River.

Æthomys bocagei Thomas.

3 specimens from Tyihumbwe River.

Æthomys chrysophilus imago Thomas.

1 specimen from Kuvangu River. 3 specimens from Mupanda. 2 specimens from each of the following: Mucoti; Mupa; Mulondo. All localities in Mossamedes.

The skin from Kuvangu River approaches in colour that of the darker-coloured species *Æ. bocagei* from Northern Angola; the skull, however, shows the characteristic well-marked supra-orbital ridges of *Æ. imago*. One of the specimens from Mucoti is peculiar in that the incisors are quite white instead of the usual rich orange-colour. This specimen is semi-adult; the skull shows no sign of disease, and the lack of colouring of the incisors must apparently be attributed to an unusual individual variation.

Æthomys namaquensis subsp. ?

1 specimen (semi-adult) from Ebanga, Benguella; 1 specimen (juv.) from Mulondo, Mossamedes.

These two specimens of *Æthomys* appear to be referable to the *namaquensis* group. The semi-adult skin is darker than usual, whilst the juvenile skin nearly resembles specimens of *Æ. n. siccatus* from the Cunene River at the

Angolan-Damaraland border. The two specimens are interesting in that, so far as I am aware, no *Æthomys* of the *namaquensis* group has been recorded north of Damaraland. In the absence of more material it is not possible to place these two specimens under any sub-specific name.

Myomys angolensis Bocage.

1 specimen from Sangeve; 1 specimen from Caluquembé, Beneguella.

Leggada bella sybilla Thomas.

16 specimens in alcohol from Mossamedes and Benguella.

Rattus rattus Linn.

1 specimen from Bimbi, Benguella.

Zelotomys shortridgei kuvelaiensis, subsp. n.

1 specimen from Kuvelai River, about 50 km. north of Mupa, Mossamedes (approximately lat. 17° South, long. 16° 30' East).

Related to *Z. shortridgei* of N'dola, Northern Rhodesia, but paler in colour and slightly smaller in size.

General colour pinkish buff (between Avellaneous and Wood Brown (Ridgway, pl. xl.); the base of the fur steel-grey. Some of the hairs behind the shoulders and on the rump are tipped with grey, which gives a speckled appearance to the latter portion of the back. Crown of head slightly darker than the nape of neck; cheeks clear pinky buff with no grey speckling. Ventral surface pinkish buff, the base of the fur white on chin, throat, inner sides of limbs, pectoral and inguinal regions; belly-fur with a narrow grey base. Outside of arms pinkish buff, the base of the hairs with no trace of grey; outside of legs pinkish buff, the base of the hairs grey. Hands, feet, and tail white.

Measurements of Type.—Female adult (B.M. no. 35.3. 20.11); 50 km. above Mupa, Kuvelai River, Mossamedes. *Hind foot* (from dried skin) 20.8 mm.

Skull.—Greatest length 30.4 mm.; condylo-basal length 29.4; (zygoma broken); breadth of brain-case (behind root of zygoma) 12.7; least interorbital constriction 4.7; alveolar length upper tooth-row 5.4.

This rat is found in the millet plantations of the natives. The country is rocky and sandy, thinly wooded. Only one specimen was obtained.

Dendromys (Poemys) ansorgei Thomas.

2 specimens in alcohol (labels lost).

This species was described from material obtained at Caconda, and is apparently very rare.

Dendromys (Poemys) leucostomus Monard.

6 specimens in alcohol (labels lost).

This mouse is rather similar in general appearance to *D. mesomelas*, but is smaller, with no sign of the dorsal stripe generally present in *D. mesomelas*, and the fifth hind toe is provided with the flat nail characteristic of the subgenus *Poemys* in place of the claw of *Dendromys*. The type-locality of *D. (Poemys) leucostomus* is Caluquembé.

Steatomys bocagei Thomas.

4 specimens in alcohol (labels lost); 8 (dried) specimens from Tyihumbwe River; 1 specimen from Kuvangu River.

Steatomys swalius umbratus Thomas.

1 specimen from Dombodola, Angolan-Damaraland border.

The type-locality of this subspecies is the Cunene River, N.W. Ovamboland, not far from Dombodola.

Saccostomus campestris Peters.

3 specimens from Tyihumbwe River; 2 specimens from Caluquembé, Benguella.

Saccostomus mashonæ De Winton.

1 specimen from Tyihumbwe River; 1 specimen from Kuvangu River.

This series appears to contain two forms separable by size, the smaller specimens being referable to *S. campestris*, whilst the larger specimens appear to be indistinguishable from *S. mashonæ*. Thomas and Wroughton (P. Z. S., Sept. 1908) have noticed these two forms occurring together in Portuguese East Africa.

Saccostomus anderssoni De Winton.

4 specimens from Dombodola, Angolan-Damaraland border.

Malacothrix typicus egeria Thomas.

2 specimens from Kuanyama, Angolan-Damaraland border.

These specimens are of interest, in that they extend the known range of this subspecies from Central Ovamboland to the Southern Angolan border.

Cryptomys kubangensis Monard.

4 specimens from Kuvangu River, Mossamedes. 3 specimens from Caluquembe. 4 specimens from Ebanga. 6 specimens from Bimbi. 1 specimen from Sangeve. All localities in Benguela.

This species appears to be distinguished from *C. bocagei*, which it resembles closely in colouring, by its slightly smaller size.

Measurements of a cotype of *C. kubangensis* compared with measurements of *C. bocagei* (in brackets) are:—*Hind foot* (taken from dried skin of *C. kubangensis*) 21.5 (25) mm.

Skull: condylo-basal length 34.8 (37.7) mm.; zygomatic width 25.8 (30); breadth of brain-case 15.4 (16); alveolar length upper tooth-row 5.8 (6).

XLVI.—*Lepiceridæ*—a new Name for the *Cyathoceridæ*.

Lepicerinus—a new Name for the *Scolytid Genus* *Lepicerus* Eichh. (*Coleoptera*). By HOWARD EVEREST HINTON (Zoological Laboratory, Cambridge).

In 1882 Sharp described the new genus and species, *Cyathocerus horni*, the genus becoming the type of his new family *Cyathoceridæ*. Previous to this, in 1855, Motschulsky had erected the genus *Lepicerus* for a new species from Panama, *inæqualis*, which he placed incorrectly in the family *Georyssidæ*. A careful comparison of the description and figure of *L. inæqualis* with the type of *C. horni* shows that both species belong to the same genus. It is not unlikely that *horni* is a synonym of *inæqualis*, but, on account of the grossly inferior

description and figure of the latter, the name *horni* should be retained until the type of *inæqualis* can be examined. In accordance with Article 5 of the International Rules of Zoological Nomenclature, the name of the type-genus, *Lepicerus*, is now used to form the family Lepiceridæ, which replaces Cyathoceridæ, as the genus *Cyathocerus* is a synonym.

Of the three described species of the family Lepiceridæ, *L. inæqualis* is known from Panama (1855, Motschulsky); *L. horni* from Guatemala (1882, Sharp), Panama (1887, Sharp), Columbia (1889, Grouvelle), Mexico (1934, Hinton), and I have recently received a specimen from Los Limones, Costa Rica, collected and sent to me by Mr. Ferd Nevermann; and *L. bufo* from Mexico (1934, Hinton).

A pertinent bibliography for the family to date is as follows:—

- (1) FORBES, WM. T. M. 1926. "The Wing Folding Patterns of the Coleoptera." J. New York Ent. Soc. xxxiv. pp. 42-68, 91-116, 2 text-figs., pls. vii.-xviii.
- (2) GROUVELLE, A. 1889. "Voyage de M. E. Simon au Venezuela (Decembre 1887-Avril 1888). Coléoptères, 2e mémoire (1). Cucujidæ, Rhysodidæ, Dryopidæ, Cyathoceridæ, Heteroceridæ." Ann. Soc. ent. France, ix. (6), pp. 157-166, pl. vi.
- (3) HINTON, H. E. 1934. "Two Coleopterous Families new to Mexico." Pan-Pacific Ent. ix. 4, 1933, pp. 160-162. (Appeared 1934.)
- (4) MOTSCHULSKY, VICTOR VON. 1855. 'Etudes entomologiques,' iv. pp. 1-84, pl. i.
- (5) SHARP, D. 1882. "Cyathoceridæ." Biol. Centr.-Amer., Coleoptera, i. 2, pp. 141-144, Tab. 4, fig. 18, 1887, Supplement, p. 775.
- (6) SHARP, D., & MUIR, F. 1912. "The Comparative Anatomy of the Male Genital Tube in Coleoptera." Trans. Ent. Soc. London, pp. 477-642, pls. xlii.-lxxviii.
- (7) ZAITZEV, PHILIP. 1908. "Catalogue des Coléoptères aquatiques des familles des Dryopidæ, Georyssidæ, Cyathoceridæ, Heteroceridæ et Hydrophilidæ." Horæ Soc. Ent. Ross. xxxvii. pp. 283-420.
- (8) ZAITZEV, PHILIP. 1910. "Dryopidæ, Cyathoceridæ, Georyssidæ, Heteroceridæ." Junk Col. Cat. Pars 17, pp. 1-68.

LEPICERINUS, new name.

Unfortunately, in 1879 (Rat. Tomic. p. 501), the name *Lepicerus* was proposed by Eichhoff for a new genus of Scolytidæ. The new generic name, *Lepicerinus* Hntn., with the genotype *L. aspericollis* (Eichh.) (*Lepicerus*), is to replace *Lepicerus*, which is a homonym of the type-genus of the family Lepiceridæ.

XLVII.—*A new Species of Notocotylus [Trematoda] from the Water-Rail.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

IN a former paper (1928) the writer pointed out certain facts which suggested that in the genus *Notocotylus* the characteristic ventral glands increased in number in direct proportion to the length of the specimens*, and that too much importance might have been given to them as a specific character. Lothar and Ursula Szidat (1933), however, believe that the number of glands per row is constant, or varies only within narrow limits, for each species. They carried out feeding-experiments with cercariæ differing only in size, but obtained from two different snails, *Lymnæa palustris* and *Planorbis corneus*, and recovered adult worms which showed different but nearly constant numbers of glands in each case. They found also that the full number of glands was present even in young worms.

These authors regard the adult form whose cercaria develops in *L. palustris* as *Notocotylus attenuatus*, and that whose cercaria develops in *P. corneus* as a new species, *N. thienemanni*†. On the other hand, Ursula Szidat (1935) describes as a distinct species *N. imbricatus* (Looss, 1893), which appears to be almost indistinguishable in the adult stage from *N. attenuatus*, but was obtained experimentally from a cercaria which differs again in size and develops in another snail, *Bithynia tentaculata*.

While, therefore, the number of ventral glands must be regarded as an unsatisfactory systematic character, there seems to be no alternative but to make use of it when it shows striking differences. At least fifteen‡ species of *Notocotylus* having three rows of ventral glands have already been described. The largest number of glands so far observed is 21 in the median row and 24–25

* The numbers of glands in the median and lateral rows in *N. attenuatus* were inadvertently transposed, and should have been given as: median row 14–15, lateral rows 16–17. Szidat and Szidat give 14–17 for the lateral rows.

† This is apparently the same form as that referred to by Szidat (1930) as "*Catatropis verrucosa*."

‡ The species attributed to *Catatropis* are not included in this number, though some of them at least should perhaps be included in *Notocotylus*.

in the lateral rows. This is in *N. parviovatus* Yamaguti, 1934. A form having an even larger number of glands per row has been obtained by the writer from the water-rail (*Rallus aquaticus*) in Great Britain, and the fact that it has been found on three occasions in the same species of bird, taken in conjunction with the constantly large number of glands, suggests that it should be regarded as a distinct species. Single specimens of this form were collected from the rectum or cæca of water-rails obtained from Norfolk (December 1931) and Sussex (September 1935), while three specimens were kindly forwarded by Mr. T. Warwick, who collected them from a water-rail obtained in Perthshire (December 1934). It is proposed to name the species

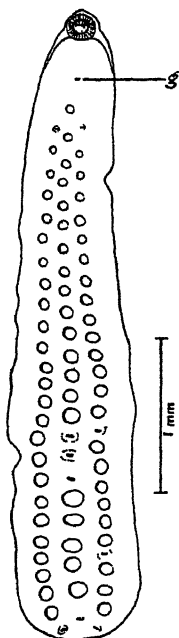
Notocotylus ralli, sp. n. (See figure, p. 476.)

The length of the specimens, after mounting in Canada balsam, varies between 3 mm. and 6.5 mm., and their greatest width is about 0.8–1.2 mm. The cuticle has the typical covering of spines. The number of ventral glands in the median row is 23–25, and in each lateral row 24–28. The smallest specimen has twenty-five glands in the median row, while the highest number in the lateral rows occurs in a specimen only 4.3 mm. long, as well as in the largest specimen. The latter has only twenty-three glands in the median row, while the right and left lateral rows contain twenty-seven and twenty-eight respectively. The median row, in all the specimens, extends further forward than the lateral rows by half the distance between two glands of a row.

The oral sucker measures 0.2–0.3 mm. in diameter. The genital pore lies a little distance behind the level of the bifurcation of the gut. The cirrus-sac measures about 1.35–1.85 mm. in length and 0.1–0.15 mm. in maximum width. The vagina is about $\frac{3}{5}$ of the length of the cirrus-sac. The vitelline glands extend forward a little beyond the posterior third of the body, but not as far as the middle. The uterus has about 27–34 loops on each side, and of these 11–17 on each side lie in front of the vitelline glands. The eggs, exclusive of their filaments, measure 0.018–0.024 mm. in length.

A species *Notocotylus diserialis*, from the water-rail, was described by Ssinitzin (1896). The original description

is not accessible to the writer, but seems to have been very inadequate. According to Kossack (1911) the worm is described as having ten transverse ridges, with papillæ at their ends, and he considers it doubtful whether the species belongs to the genus *Notocotylus*, *sensu* Odhner. It seems, therefore, improbable that the form here described is identical with Ssinitzin's species.



Notocotylus ralli. Ventral view, showing ventral glands (retracted glands indicated by dotted outlines). g., genital pore.

REFERENCES.

- BAYLIS, H. A. 1928. "A new Species of *Notocotylus* [Trematoda], with some Remarks on the Genus." *Ann. & Mag. Nat. Hist.* (10) ii. pp. 582-585.
- KOSSACK, W. 1911. "Ueber Monostomiden." *Zool. Jahrb., Syst.* xxxi. pp. 491-590, pls. xiii.-xv.
- SSINITZIN, D. F. 1896. "[Entoparasitic Worms of Birds in the Vicinity of Warsaw]" (in Russian). *Trav. Lab. Cab. Zool. Univ. Varsovie*, pp. 1-20, 1 pl. [n.v.]
- SZIDAT, L. 1930. "Die Parasiten des Hausgeflügels. 4. *Notocotylus* Diesing und *Catantropis* Odhner, &c." *Arch. f. Geflügelk.* iv. pp. 105-114.

- SZIDAT, L., and SZIDAT, U. 1933. "Beitrage zur Kenntnis der Trematoden der Monostomidengattung *Notocotylus* Dies." Zentralbl. f. Bakt., &c. I. Abt. Orig. cxxix. pp. 411-422.
- SZIDAT, U. 1935. "Weitere Beiträge zur Kenntnis der Trematoden der Monostomidengattung *Notocotylus* Diesing." Zentralbl. f. Bakt., &c. I. Abt. Orig. cxxxiii. pp. 265-270.
- YAMAGUTI, S. 1934. "Studies on the Helminth Fauna of Japan. Part 3. Avian Trematodes, II." Jap. Journ. Zool. v. pp. 543-583.

XLVIII.—*Descriptions and Records of Bees.*—CLIV.

By T. D. A. COCKERELL, University of Colorado.

ALL the bees recorded below will be found in the collection of the British Museum.

Systropha (*Systrophidia*, subgen. nov.) *ogilviei*, sp. n.

♀.—Length about 10·3 mm., anterior wing 7·2.

Black, including mandibles, antennæ, and legs; eyes black; mouth-parts greatly elongated, the tongue extremely long and slender; labial palpi with the first three joints broadened and in a straight line, the small fourth joint diverging, broadened at base, in one view appearing straight, with the end slender, in another strongly curved, with the end broad; first joint of labial palpi relatively short, second very long, third perhaps as long as first; blade of maxilla as in typical *Systropha*, short and blunt, but very bristly; maxillary palpi very bristly, short, the last two joints extending beyond the blade, the end of penultimate joint about level with end of first joint of labial palpi; facial quadrangle about square; clypeus short and as usual in *Systropha*; hair of head white, but a fringe of long copper-red hairs overlapping ends of mandibles; flagellum very short and thick, a shining space at each side of ocelli; mesothorax glistening, scutellum dull; area of metathorax very short, glistening (not dull with a shining rim, as it is in typical *Systropha*); hair of mesothorax and tubercles yellowish white, of scutellum pale ferruginous, of other parts of thorax dull white; mesothorax in front with three strong grooves; tegulæ large, reddish brown. Wings dusky hyaline, stigma pale reddish, nervures brown; venation normal for *Systropha*; second cubital cell higher than broad, receiving first recurrent nervure

not far from end; third cubital cell on marginal shorter than second on marginal; basal corner of first discoidal cell forming a larger angle than in *S. curvicornis* (Scopoli), but it is still larger in *S. difformis* Smith. Legs with pale hair, hind basitarsi very long. Abdomen dullish, the tergites with very broad dark brown apical depressed portions; these depressions are thinly clothed with appressed whitish hair; the discs of tergites 3 to 5 have thin pale fulvous hair, the margin of fifth and the apex have bright golden-ferruginous hair; the venter has much dull white hair; apical plate very small.

S.W. Africa: Okahandja, Jan. 25, 1934 (*J. Ogilvie*).

Perhaps nearest to *Systropha rhodesiensis* Friese, which has thick fulvous hair on mesothorax and dark brown hair on tergites 3 to 6. The new subgenus *Systrophidia* is primarily based on the mouth-parts. In typical *Systropha* the tongue is much shorter and the maxillary palpi are greatly enlarged, with the third joint extremely long, and the whole palpus rivalling the labial palpi in length; the labial palpi have three enlarged broadened joints and a small divergent one at end. In *Systrophidia* the maxillary palpi are entirely different, being short, but the labial palpi are of the same general type as those of *Systropha*. I should have been inclined to set forth *Systrophidia* as a full genus but for the fact that *Systropha difformis*, from Burma and Siam, is intermediate, having the long slender tongue and the maxillary palpi not nearly so long as in typical *Systropha*, but slender and much longer than in *Systrophidia*.

Meliturgula minima Friese.

Cape Province: Beaufort West, Nov. 28 (*L. Ogilvie*); Upington, Dec. 7 (*J. Ogilvie*); males.

Although the females of *Meliturgula* and *Pæcilomelitta* look very different the males are more similar, and both venation and mouth-parts are of the same pattern. It must be concluded that the two genera are closely allied.

Pæcilomelitta obscurata, sp. n.

♀.—Length about 6 mm.

Narrow, with the build of *P. flavida* Friese, but apparently a distinct species, with the light markings

reduced; face-marks pale lemon-yellow, the clypeus yellow with a black line on each side, the cuneiform space between upper part of clypeus and lateral marks all black; lateral marks without the broad band to top of head which is seen in *P. flavida*; mark above clypeus resembling that of *P. flavida*, broad on supraclypeal area, with a narrow stem, which again broadens below middle ocellus; cheeks black, with an elongate yellow mark on lower half; scape with an obscure pale stripe in front; flagellum pale red beneath; mesothorax with two yellow stripes on disc, and anterior corners yellow; scutellum black in middle, the black area broad in front and behind; postscutellum yellow; metathorax with an interrupted yellow band; tubercles and a mark behind them yellow, but sides of thorax otherwise black; tegulæ and wings as in *P. flavida*, except that the wings are shorter and more greyish; femora black, the knees yellow on front and middle ones, red on hind ones; front tibiæ yellow, with a black mark behind, the other tibiæ and the tarsi pale reddish; abdomen dull except the pale shining hind margins of tergites; tergites black, the first four with a transverse band, yellow on the fourth, pale red on the others; the band on first tergite linear, on second to fourth broad except laterally, with a median emargination, the broad part abruptly truncate sublaterally, leaving only a line at extreme sides, and this lacking on fourth; fifth tergite with a large kidney-shaped yellow mark; apex with a very pale reddish fringe; first tergite with a pair of sublateral tubercles near the margin; venter with dark markings in middle.

S.W. Africa: Okahandja, Jan. 24, 1934 (*J. Ogilvie*).

Pæcilomelitta latifrons, sp. n.

♂.—Length about 6 mm., anterior wing 5.2.

Black, without the usual yellow markings, but flagellum light red beneath except at base; head quadrate, extremely broad, width fully 2 mm.; head and thorax with thin white hair, abdomen without hair-bands, but the hind margins of the tergites pallid; mandibles long, obscurely reddish subapically; clypeus shining, narrowly produced laterally, at its upper margin a raised curved transverse keel which is distinctly pallid; sides of vertex shining; mesothorax and scutellum highly

polished, metathorax dull; tegulæ small and hyaline. Wings hyaline, somewhat milky, the stigma and nervures amber; the stigma is larger and redder and the third cubital cell is considerably larger than in *P. flavida*. Legs black, with thin white hair. Abdomen broad, somewhat shining, the margins of tergites distinctly so; small joints of hind tarsi red.

S.W. Africa: Otjiwarango, Jan. 1, 1934 (*L. Ogilvie, J. Ogilvie*).

Three specimens, known from all others by the very broad head and black colour, except that *P. fuliginosa* Friese, described from the female, is similarly black. It may possibly be the male of *P. fuliginosa*, but I think this is improbable.

Pæcilomelitta robustula, sp. n.

♂.—Length about 6.2 mm.

Black, the head and thorax with long white hair, the abdomen without hair-bands; scape with a pale yellow stripe in front, flagellum very thick, pale orange beneath; mandibles whitish, becoming reddish apically; labrum black; clypeus cream-colour, narrowly produced at sides; supraclypeal area creamy white, the light colour deeply notched above; thorax without light markings; mesothorax and scutellum highly polished; base of metathorax dull and granular, with a shining rim. Wings milky hyaline, stigma very pale, with darker margin. Knees, tarsi, and base of hind tibiae pallid. Abdomen with the first two tergites dull, the others shining; no hair-bands.

This is nearly the same as what I determined (from Okahandja) as the male of *P. flavida* Friese, but it is considerably more robust, with much broader abdomen (its width nearly 2 mm.), broader front, and no pale lines along inner orbits or pale lateral marks of any kind.

S.W. Africa: Gobabis, Dec. 17, 1933 (*L. Ogilvie*).

I have both sexes of *P. flavida* (the male like the one from Okahandja) from Gobabis.

Pæcilomelitta fuliginosa Friese.

S.W. Africa: Okahandja, Jan. 23–25, 1934 (*J. Ogilvie*); five females.

Parafidelia pallidula incerta, subsp. n.

♂.—Agrees with *P. pallidula* Ckll., except as follows :—Considerably smaller, anterior wing 9 mm.; more than basal half of mandibles light yellow; labrum shining, pale yellow, with a dusky red spot at each side; the very broad pale yellow clypeal band with no incursions of black below, but with a pair of minute grey spots, close together, near margin; tegulæ light red; wings milky hyaline.

S.W. Africa: Otavifontein, Dec. 25, 1933 (*J. Ogilvie*).

Possibly a distinct species, but certainly very near to *P. pallidula*. It may be only an individual variation.

Scapter flavitarsis, sp. n.

♂.—Length about 7.5 mm., anterior wing 5.

Slender, black, with pure white hair, long and dense on face, entirely covering the surface, very long on pleura; tergites 2 to 4 seen from above appearing slightly grey basally, but in lateral view showing pure white bands of short tomentum, broadest in middle; tongue short and bifid; head broader than long; eyes prominent, black; flagellum clear orange-ferruginous beneath; mesothorax and scutellum shining but strongly punctured; mesothorax not depressed or grooved in middle; area of metathorax densely striate; tegulæ small and dark. Wings clear hyaline; stigma large, light red; nervures pale red; basal nervure falling far short of nervulus; second cubital cell receiving recurrent nervures equally far from base and apex. Legs slender, black, with the tarsi light yellow. Abdomen very finely punctured, first tergite polished, no hair-bands on margins of tergites; hind margins of tergites narrowly pallid.

Cape Town: Zeekoe Flei, June 9, 1934, two males (*J. Ogilvie*).

Runs in Friese's table (1924) to *S. nitidus* (Friese), but that is only 6 mm. long, with different legs. The light tarsi suggest the much smaller *S. albitarsis* (Friese). A female with the same data, lacking its head, is presumed to belong to *S. flavitarsis*. It has black tarsi, and the area of metathorax, except basally, is polished.

Scapter pallidicinctus Cockerell.

Orange Free State : North Bank Halt, Norval's Pont, April 16, 1934, male (*J. Ogilvie*).

In lateral view pure white bands are seen at bases of tergites 2 to 4.

Hesperapis alicæ Cockerell.

Cape Province : Beaufort West, Nov. 25, 1933, one male (*L. Ogilvie*).

Hesperapis turneri Cockerell.

Cape Province : Beaufort West, Nov. 29, 1933, females (*J. Ogilvie*, *L. Ogilvie*) ; Nelspoort, Dec. 4, female (*J. Ogilvie*).

A male from Beaufort West, Nov. 29, is only about 6.5 mm. long, but I cannot make it out to be a different species.

Hesperapis nanula, sp. n.

♂.—Length about 4.5 mm., anterior wing 3.

Black, with the labrum and mandibles light red ; flagellum light reddish orange, with the last two joints black ; tibiæ and tarsi light red ; pubescence white, on face long and dense, covering surface, on thorax thin, but abundant behind scutellum and on pleura ; margins of tergites with slender clear white bands. Face broad, the orbits only slightly converging below ; eyes brown ; mesothorax and scutellum highly polished, base of metathorax shining ; tegulæ very pale. Wings hyaline, stigma small, dusky reddish, nervures pale ; second cubital cell receiving first recurrent nervure very near base, the second not quite so near apex. Abdomen dullish, curved, with the apex directed forward.

Cape Province : Beaufort West, Nov. 30, 1933 (*J. Ogilvie*).

Known from the other species by the small size and black end of flagellum. In some respects it resembles the Californian *H. rufipes* (Ashmead).

Thaumatosoma filiferum, sp. n.

♂.—Length nearly 6 mm., anterior wing 3.6.

Black, with white hair, dense along inner orbits ; mandibles broad, with the subapical region bright red ;

clypeus with a shining band in middle ; scape very short, black ; flagellum greatly elongated, filiform, the joints hardly swollen laterally, apex with a small black disc ; mesothorax and scutellum shining but well punctured, base of metathorax shining ; tegulæ black. Wings dusky, second recurrent nervure nearer to end of second cubital cell than first is to base. Legs black, with thin white hair, pulvilli present. Abdomen broad, closely punctured, the white hair-bands hardly developed except on first tergite.

Cape Province : Bot River, Nov. 11, 1933 (*J. Ogilvie*).

A second specimen from the same place, but Nov. 7 (*L. Ogilvie*), is smaller (about 5 mm.) and not so robust, but seems not to be a distinct species. I have not described this species at greater length, as it is just like *T. moniliferum* Ckll., except that it is distinctly smaller and the flagellum does not show the strongly moniliform joints, while the femora are entirely black and the apical margin of the sixth tergite is much broader.

Eucara macrognatha (Gerstaecker).

Bechuanaland : Palapye Road, March 5 and 6, both sexes (*J. Ogilvie*, *L. Ogilvie*).

The hair of thorax posteriorly is fulvous, not black.

Xylocopa sicheli Vachal.

Orange Free State : Donkerpoort, April 18 (*J. Ogilvie*) ; North Bank Halt, Norval's Pont, April 16 (*J. Ogilvie*).

Mesotrichia inconstans (Smith).

S.W. Africa : Grootfontein, Jan. 1929 (*J. N. Justice*) ; Bechuanaland : Palapye Road, March 6 (*J. Ogilvie*).

XLIX.—*New Species and Subspecies of Zygænosia.*

By Lord ROTHSCHILD, F.R.S.

Zygænosia flavoplagiata flavoplagiata, sp. n.

♂♀.—Pectus, legs, frons, and abdomen below dull orange ; antennæ black, collar and front half of patagia in ♀ orange, in ♂ black like thorax, thorax black, abdomen above orange, anal segment and claspers in ♂ black.

Fore wings greyish vitreous, somewhat opaque, nervures sooty black, and broad band at termen greyish sooty black, terminal band narrower in ♀, a broad internal band not reaching tornus orange. Hind wings dull black, costal area greyish white.

Length of fore wing, ♂ 12 mm., ♀ 13 mm.; expanse, ♂ 26 mm., ♀ 28 mm.

Hab. Goodenough Island, 2500–4000 feet, April 1913 (A. S. Meek coll.), 3 ♂♂, 2 ♀♀ (♂ type).

Zygænosia flavoplagiata restricta, subsp. n.

♂.—Differs from *f. flavoplagiata* in the orange internal band on fore wing being much shorter, only reaching to $\frac{1}{3}$ of the wing.

♀.—Differs in this band reaching about halfway to tornus.

Hab. Hydrographer Mts., British New Guinea, 2500 feet, Jan. 1918 (Eichhorn Bros. coll.), 5 ♂♂, 3 ♀♀.

Zygænosia suffusa, sp. n.

♂.—Pectus, legs, frons, underside of abdomen buffish orange-yellow; antennæ black; thorax and first joint of abdomen black, an orange-buff dot on patagia; rest of abdomen orange-buff, last segment and claspers black.

Fore wing semivitreous greyish white, almost completely suffused with buffish orange, a broad band of orange along inner area enclosing vein 1, nervures, termen, and apex dull black. Hind wing dull black, costal area cream-coloured, slightly suffused with buff.

♀.—Differs in having whole head, patagia, and abdomen above orange-buff.

Length of fore wing, ♂ 10 mm., ♀ 11 mm.; expanse, ♂ 23 mm., ♀ 25 mm.

Hab. Hydrographer Mts., British New Guinea, 2500–4000 feet, March 1918 (Eichhorn Bros. coll.), 8 ♂♂, 1 ♀.

Zygænosia affinis, sp. n.

♂.—Most closely allied to *fumigata* Pag., but differs in having head, legs, pectus, and abdomen golden-yellow, NOT BLACK, with underside of abdominal segments only yellow. Above the thorax and abdomen are dull golden-yellow, with centre of thorax and anal segment of abdo-

men black, NOT as in *fumigata* entirely black. Wings duller and paler black than in *fumigata*, and the basal orange spot of the fore wings is replaced in *affinis* by a yellow quadrate streak.

♀.—Abdomen above entirely yellow.

The three Squally Island examples are small, but there are St. Mathias ones equally small.

Length of fore wing, ♂ 8–13 mm., ♀ 9–11 mm.; expanse, ♂ 18–28 mm., ♀ 20–24 mm.

Hab. St. Mathias Island, June–July 1923 (A. F. Eichhorn coll.), 5 ♂, 3 ♀; Squally Island, August 1923 (A. F. Eichhorn coll.), 2 ♂, 1 ♀.

Zygænosia fumigata nigrescens, subsp. n.

♂♀.—Differs from *f. fumigata* above in being entirely black and more semivitreous, the basal orange spot on the fore wings being absent.

Hab. New Hanover, March 1923 (A. S. Meek coll.), 6 ♂, 4 ♀.

Zygænosia papua eximia subsp. n.

♂.—Differs from *p. papua* Oberth. in its larger size, completely vitreous fore wings, orange INSTEAD of BLACK vertex, and front half of thorax, also in having second as well as first segment of abdomen black and the orange on inner area of fore wing much brighter.

Length of fore wing, *p. papua*, 12 mm.; expanse 26 mm.

Length of fore wing, *p. eximia*, 13½ mm.; expanse 29 mm.

Hab. Mount Goliath, 5000 feet, Central Dutch New Guinea, 139° East long., March 1911 (A. S. Meek coll.), 1 ♂.

L.—*New Species of Chionæma, Asura, and Miltochrista.*

By Lord ROTHSCHILD, F.R.S.

Chionæma nigromarginata, sp. n.

♀.—Legs, pectus, and palpi black; head, collar, and thorax golden-orange, a black spot on hind part of thorax; abdomen black, last two segments above and last four below golden-orange.

Fore wing golden-orange, outer ¼ of wing, costal and inner margin black. Hind wing golden-yellow, bordered broadly with black.

♀.—Length of fore wing 24 mm. ; expanse 54 mm.

Hab. Talesea, New Britain, March–April 1925 (A. F. Eichhorn coll.), 1 ♀.

Chionæma basiflava, sp. n.

♂.—This has the fore wing very strongly truncated, even more than in the *miles* group.

Pectus orange ; head, antennæ, thorax, and abdomen black, abdominal tuft orange.

Wings black, basal $\frac{1}{3}$ of the fore wing except extreme base, costal and inner margins orange ; basal $\frac{1}{3}$ of hind wing orange rayed with black.

♀.—Pectus, legs, antennæ, and thorax steel greenish black ; an indistinct narrow brownish-yellow collar ; abdomen black, anal tuft, and side-lines of præanal segment dull orange.

Fore wings golden-orange, base obliquely, a narrow costal line and outer $\frac{1}{3}$ of wing deep black, this black outer $\frac{1}{3}$ is strongly concave basad. Hind wing paler, orange-yellow broadly edged with black.

Length of fore wing, ♂ 12 mm. ♀ 16 mm. ; expanse, ♂ 28 mm., ♀ 36 mm.

Hab. New Ireland, Dec. 1923 and March–April 1924 (A. F. Eichhorn coll.), 1 ♂, 3 ♀♀.

Chionæma scintillans, sp. n.

♂.—This beautiful species is closely allied to the *miles* group of *Chionæma*, but differs from all the others in the sexes being alike.

Pectus, legs, head, patagia, thorax, and tegulæ brilliant metallic silvery green, as is the entire abdomen below ; abdomen above black, last segment metallic green, abdominal tuft black.

Wings black above, an antimedial patch of metallic silvery green, a large medio-postmedian patch of maroon-crimson, a postdiscal band of metallic green ; fore wing strongly truncate.

♀.—Similar, but larger, with less truncate fore wings.

Length of fore wing, ♂ 14 mm., ♀ 19 mm. ; expanse, ♂ 33 mm., ♀ 44 mm.

Hab. New Ireland, January 1924 (A. F. Eichhorn coll.), 1 ♂, 3 ♀♀.

Chionæma tripunctata, sp. n.

♀.—Differs from *Ch. bianca* Walk. in having on fore wing a third black spot between and slightly below those on discocellulars and end of cell. The black outer band of the postmedian double band also is quite straight, sharply angled outwards at vein 1, not waved or serpentine as in *bianca*.

Length of fore wing, ♀ 19 mm. ; expanse 42 mm.

Hab. Aberdeen, Andaman Islands, 1 ♀.

Chionæma pellucida, sp. n.

♂.—This very curious species at first sight gives the impression of a *Miltochrista*, until one notices the scent-organ on the fore wing.

Pectus grey, frons white, legs dirty white, thorax salmon-pink, abdomen whitish grey, anal tuft dirty cream-buff.

Fore wings semihyaline pale grey, subbasal transverse patch and outer $\frac{1}{4}$ of wing salmon rose-pink, outer margin and outer $\frac{1}{3}$ of costa dull yellow, antemedian, median, and postmedian transverse serpentine bands salmon-rose-pink, the median and postmedian bands joined below costa by a half hoop of salmon-rose-pink. Hind wings grey, with black stigma. Below the wings are grey, fore wing with a costo-subcostal black streak, and $\frac{2}{3}$ distad from base a large scent-organ consisting of a tuft of strong black-brown androconial hairs, outer $\frac{1}{4}$ of wing buffish yellow.

Length of fore wing, ♂ 11 mm. ; expanse 24 mm.

Hab. Singolangoe, Tengger, Java, April 1934 (F. P. A. Kalis coll), 4 ♂♂.

Chionæma postgrisesens, sp. n.

♂.—Pectus rosy yellow, legs rusty yellowish-brown with white band on tibiæ, frons white, thorax brick-red with two black dots on mesothorax, abdomen grey, anal tuft buff.

Fore wing white, base brick-red edged by an oblique black line, broad medio-antimedial and postmedian bands brick-red strongly bordered each side with black, apex broadly brick-red with strong projecting tooth basad and edged with black on inner side. Hind wing

semivitreous white, outer $\frac{1}{2}$ washed strongly with grey as is abdominal area; a black dot at end of cell in fore wing.

♀.—Differs in having broader fore wings and rounder hind wings, and the latter are uniform sooty grey.

Length of fore wing, ♂ 21 mm., ♀ 23 mm.; expanse, ♂ 47 mm., ♀ 51 mm.

Hab. Ramboekers Tondano (*Weigal*), 1 ♂, type; Sawangan, N. Celebes, 1 ♀; Larat (*H. Kühn coll.*), 1 ♂.

Chionæma stresemanni, sp. n.

♂.—Differs from *bellissima* Moore in the pectus being entirely white, the coxæ white NOT grey and pink, in the anal tuft being white tinged with crimson NOT yellowish crimson.

The fore wing differs from that of *bellissima* in being entirely white NOT having the outer $\frac{1}{4}$ gamboge-yellow; the hind wing has costal area white and fringe also white NOT yellowish salmon-colour.

On the fore wing the subbasal, antimedial, and post-medial red bands are much narrower than in *bellissima*, and there is a rather evanescent curved crimson post-discal band.

Length of fore wing, ♂ 22 mm.; expanse 49 mm.

Hab. Batang, Padang Valley, Perak, 9th Oct. 1914 (*E. Stresemann coll.*), 1 ♂.

Asura triangularis, sp. n.

♂.—Pectus, legs, and frons carmine-scarlet, head and thorax brown tinged with yellowish brick-red, abdomen salmon-pink washed with grey-brown.

Fore wing yellowish grey-brown with irregular slight pink suffusion, the subcostal line in its outer $\frac{2}{3}$ and the outer margin scarlet-crimson, a triangular salmon-buff patch reaching from inner margin to cell, a salmon-pink spot on costa. Hind wings semivitreous buff washed with pink, upper $\frac{1}{2}$ of fringe sooty black.

♀.—Larger and with more red on all margins of fore wings and hind wings semivitreous salmon-rose.

Length of fore wing, ♂ 12 mm., ♀ 15 mm.; expanse, ♂ 28 mm., ♀ 35 mm.

Hab. Upper Setekwa River Snow Mts., Dutch New Guinea, 2000–3000 feet, Aug. 1910 (*A. S. Meek*), 1 ♂ type;

Kumusi River, N.E. British New Guinea, low elevation, Aug. 1907 (A. S. Meek), 1 ♂; Bantibasa District, Kratke Mts., New Guinea, 4000–5000 feet, July 1932 (R. Shaw-Meyer coll.), 3 ♂♂, 1 ♀; Hydrographer Mts., British New Guinea, 2500 feet, Jan.–March 1918 (Eichhorn Bros. coll.), 2 ♀♀.

Asura simillima, sp. n.

♂♀.—Differs from *A. triangularis* Rothsch. in having the triangular patch on fore wing much obliterated, and on the inner side is a median transverse band of sooty grey-black reaching the costa.

Length of fore wing, ♂ 12 mm., ♀ 15 mm.; expanse, ♂ 28 mm., ♀ 35 mm.

Hab. Upper Aroa River, British New Guinea, March–April 1902 (A. S. Meek coll.), 1 ♂ type, 4 ♀♀; Kumusi River, N.E. British New Guinea, low elevation, Aug. 1907 (A. S. Meek coll.), 3 ♀♀; Hydrographer Mts., British New Guinea, 2000 feet, 2 ♀♀.

Asura obscuroidiscalis, sp. n.

♂♀.—Differs from *efulgens* Pagenst. in having the area between the median and submarginal areas sooty grey-black NOT orange-scarlet.

Hab. Goodenough Island, 2500–3000 feet, March and April 1913 (A. S. Meek coll.), 2 ♂♂, 6 ♀♀.

Asura mediofascia, sp. n.

♂♀.—Pectus, legs, head, thorax except hinder $\frac{1}{3}$ on upper side scarlet; abdomen paler washed with buff.

Fore wings dull black, median third scarlet, irregularly convex distad. Hind wing buffish pink, outer $\frac{2}{3}$ pale sooty black.

Length of fore wing, ♂ 11 mm., ♀ 14 mm.; expanse, ♂ 26 mm., ♀ 33 mm.

Hab. New Hannover, March 1923 (A. S. Meek coll.).

Asura eichhorni, sp. n.

♂.—Head, legs, pectus, and body similar to *mediofascia*.

Fore wings sooty brown. Hind wing outer $\frac{2}{3}$ paler sooty brown, basal $\frac{1}{3}$ dull pink.

Size equal to *mediofascia*.

Hab. New Ireland, Dec.—Jan. 1923–1924 (A. F. Eichhorn coll.), 1 ♂.

This may turn out to be a subspecies of *mediofascia*.

Asura luzonica pardalina, subsp. n.

♂.—Differs from *l. luzonica* by having the postdiscal orange band of fore wing divided by only one black streak and a dot, so that the band appears to be divided into two instead of three patches. On the hind wings the central $\frac{1}{4}$ of wing is semivitreous greyish white and the costal area of orange reduced, NOT as in *l. luzonica* the costal $\frac{1}{2}$ of hind wing orange and rest of wing black.

Hab. Kolambuga, Lanao Plains, Mindanao, May and June 1914 (A. E. Wileman coll.), 5 ♂♂, 1 ♀.

Miltochrista erubescens, sp. n.

♂.—This curious species is intermediate between *postnigra* Hmps. and *cardinalis* Hmps. in size and shape, but is nearest to *cardinalis* in colour and pattern.

Pectus, legs, and palpi black; frons and thorax deep crimson; abdomen black.

Fore wing deep crimson; a black streak reaching from cell to termen widening out to the termen. Hind wing costal half semivitreous whitish strongly washed with crimson; rest of wing black. Wings rounded at apex and narrow.

Length of fore wing, ♂ 10 mm.; expanse 23 mm.

Hab. Khasia Hills, Assam, July 1896 (Native coll.), 1 ♂.

Miltochrista euprepia ab. *lutescens*, nov.

Differs from normal form by the absence of all red coloration, the ground-colour of the wings being creamy yellow and the body and thorax somewhat deeper yellow. The slate-coloured markings on wings and body of the normal form being changed to dark brown.

Described from 17 ♂♂, 9 ♀♀ from Nongkodjadjar, E. Java, 4000–5000 feet, May 1932–Dec. 1933 (A. M. R. Wegner and J. P. A. Kalis coll.). There are at Tring from the same collectors 51 ♂♂, 30 ♀♀ of the normal form.

LI.—*A new Fish of the Genus Clupea from Chile.* By J. R. NORMAN, Department of Zoology, British Museum (Natural History).

THE fish commonly known in Chile as "Sardina" was identified by Guichenot * as *Clupea fuegensis* Jenyns, and it appears under this name in the catalogue of Chilean fishes published by Delfin †. Through the kindness of Mr. V. Cavendish Bentinck (son of Mr. F. Cavendish Bentinck, a trustee of this Museum), of the British Embassy at Santiago, the British Museum has recently received several very interesting collections of marine fishes from Chile, which include examples of some species previously unrepresented in the National collection ‡. Among the last consignment received in July of this year is a number of examples of the Sardina from Talcahuano, where the fish is said to be very common. Comparison of these with authentic material of *Clupea fuegensis* § from the Magellan-Falkland Islands region shows that the Chilean form is quite distinct.

Clupea bentincki, sp. n.

Clupea fuegensis (non Jenyns), Guichenot, 1848, in Gay, Hist. Chile, Zool. ii. p. 320; Delfin, 1901, Cat. Peces Chile, p. 40; Thompson, 1916, Proc. U.S. Nat. Mus. 1. p. 457.

Depth of body $3\frac{1}{2}$ to 4 in the length, length of head $3\frac{1}{3}$ to $3\frac{2}{3}$. Snout about as long as eye, diameter of which is $4\frac{1}{4}$ to $4\frac{1}{2}$ in length of head; maxillary extending nearly or quite to below middle of eye. Tongue smooth or with traces of a narrow patch of minute teeth; usually a series on the palatines; vomer toothless. 75 to 95 gill-rakers on lower part of anterior arch. Præoperculum narrower than operculum, which is about as broad as diameter of eye. 42 to 46 scales in a longitudinal, 13 to 15 in a trans-

* 1848, in Gay, Hist. Chile, Zool. ii. p. 320.

† 1901, Cat. Peces Chile, p. 40.

‡ The following gentlemen were responsible for the collection and preservation of the specimens:—Señor Luis A. Lagos, Director General of Fisheries; Professor Carlos Oliver Schneider, Director of Concepción Museum; and Señor Pedro Golusda, Inspector of Fisheries at Lautaro. I take this opportunity of offering them my sincere thanks.

§ For a description of this species, see Regan, 1916, Ann. & Mag. Nat. Hist. (8) xviii. p. 4.

verse series; ventral scutes feebly keeled and not sharply pointed, 18 to 20+10 to 12. Dorsal 16 to 18; origin equidistant from end of snout and base of caudal or nearer to the latter. Anal 16 to 19. Pelvics 8-rayed, inserted in or a little behind the vertical from origin of dorsal. Vertebrae 45 or 46.

Described from 12 specimens, 110 to 155 mm. in total length. A specimen of 150 mm. has been selected as the holotype.

Clupea bentincki differs from all other members of the genus in having an increased number of gill-rakers. From *C. fuegensis*, to which it is nearly related, it may be further distinguished by the rather deeper body, larger head, smaller eye, fewer ventral scutes in front of the pelvic fins, and smaller number of vertebrae. The synopsis of the species of *Clupea* given by Regan* may be modified to include the new species.

- | | |
|---|--------------------------|
| I. Pelvic fins 9- (rarely 8- or 10-) rayed; vomer toothed. Dorsal 17-20. Anal 14-20. Vertebrae 50-59. 40-51 gill-rakers on lower part of anterior arch. (Northern species.) | |
| A. Ventral scutes all keeled | 1. <i>harengus</i> . |
| B. Ventral scutes in front of pelvic fins not keeled | 2. <i>pallasi</i> . |
| II. Pelvic fins 8-rayed. Dorsal 15-19. Anal 17-21. Vertebrae 42-51. (Southern species.) | |
| A. Vomer toothed. | |
| 1. Depth of body $4\frac{1}{2}$ in length. Scales 48/13-14 | 3. <i>antipodum</i> . |
| 2. Depth of body 3 to $3\frac{1}{2}$ in length. Scales 43-44/10-11 | 4. <i>muelleri</i> . |
| B. Vomer toothless. | |
| 1. 38-40 gill-rakers on lower part of anterior arch. | |
| a. Vertebrae 49-51 | 5. <i>fuegensis</i> . |
| b. Vertebrae 46 | 6. <i>bassensis</i> . |
| 2. 75-95 gill-rakers on lower part of anterior arch | 7. <i>bentincki</i> . |
| III. Pelvic fins 7-rayed; vomer toothless. | |
| A. 34-40 gill-rakers on lower part of anterior arch. Anal 17-21. Scales 44-50/12-15.. | 8. <i>sprattus</i> . |
| B. 25-30 gill-rakers on lower part of anterior arch. | |
| 1. Anal 22-23. Scales 42/15. Depth 3 to $3\frac{1}{2}$ in length | 9. <i>arcuata</i> . |
| 2. Anal 17-20. Scales 42/11-12. Depth $3\frac{1}{2}$ to 4 in length | 10. <i>melanostoma</i> . |

* 1917, Ann. & Mag. Nat. Hist. (8) xix. p. 227.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 101. MAY 1936.

LII.—*Thysanoptera from Africa.*

By DUDLEY MOULTON, Redwood City, California.

THIS paper includes the descriptions of thirteen new species, two new varieties, and the finding of ten other species, all belonging to the Terebrantia. The collections for most part were made by Mr. R. E. Turner in South Africa and were forwarded to me through the courtesy of Mr. Frederick Laing of the British Museum, London. Other material is also considered in this report, and in each case due credit is given to the collector. Specimens in these collections belonging to the Tubulifera will be reported on in a later paper. I wish to express my sincere thanks to Mr. Turner and others, and especially to Mr. Laing, for their co-operation, and I hope that the records published here will be helpful to others interested in this group of insects. Types of new species and others included in this report are being deposited with the British Museum; the balance of the material remains in the author's collection.

Superfamily **ÆOLOTHRIPOIDEA** Hood.

Family **Orothripidæ** Bagn.

Genus **AUDIOTHRIPS** Moulton.

Audiothrips monilis Moulton, sp. n.

Male holotype.—Colour of head, pterothorax, abdomen, and hind legs uniformly deep brown; prothorax light brownish yellow forming a distinct collar-like band; coxæ of fore legs concolorous with prothorax; antennal

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 33

segments 1 and 2 coloured like head; fore wings with a longitudinal brown band along posterior margin, this broadened in the middle of the wing and reaching the anterior margin to form a cross-band; other portion of wings clear. (Antennal segments 3 to 9 and fore and middle legs lost from the unique specimen.)

Total body-length 1.30 mm.; head, length .19 mm., width .176 mm.; prothorax, length .118 mm., width .19 mm.; width of pterothorax .294 mm.

With the characters of the genus including geniculate, five-segmented maxillary palpus and four-segmented labial palpus.

Type-material.—Male holotype taken in November, 1930 (*R. E. Turner*) (*Moulton*, no. 5152).

Type-locality.—Somerset East, Cape Province, South Africa.

It is barely possible that this may be the male of *Audiothrips perplexus* Moulton, as one female specimen of this latter species was found in the same collection, but the distinctive colouring of the prothorax and the broadened brown bands of the fore wings would seem to set it apart as a separate species.

Family *Æolothripidæ* Uzel.

Genus *ÆOLOTHRIPS* Haliday.

Æolothrips scabiosatibiæ Moulton.

Two specimens of this species were taken at Mossel Bay, Cape Province, in June–July 1930 (*R. E. Turner*). The species is especially characterized by its enlarged fore femora and the spine bearing tubercles on ventral side of fore tibiæ (*Moulton*, no. 5146).

Æolothrips brevicornis Bagnall.

Seven females and two males of this species were collected at Mossel Bay, Cape Province, in June–July 1930 (*R. E. Turner*). The females were briefly described by Mr. Bagnall as being reddish or chestnut-brown and the third antennal segment yellowish brown. The third antennal segment is lighter at the base and shades gradually to brown at the tip. Segments 6 to 9 are closely joined and together shorter than segment 5.

DESCRIPTION OF MALE.

Prevailing colour chestnut-brown with head and tip of abdomen dark brown, other abdominal segments brownish yellow; antennal segments 2 and 3 light brownish yellow, lighter than in the female; legs with all femora darkened above and light yellowish below. Claspings organs rudimentary and not conspicuous. Antennal segments 6 to 9 closely joined and shorter than segment 5 as in female (*Moulton*, no. 5146).

Æolothrips brevicornis Bagnall,
var. *fuscus* Moulton, nov.

Female holotype.—Colour dark chestnut-brown including antenna and legs except only third antennal joint, which is abruptly clear yellow with a narrow dark brown circle at extreme tip; wings as in *fasciatus* Linn.

Total body-length 1.42 mm. Antennal segments, length (width): III. 100 (23); IV. 96 (23); V. 63; VI.–IX. 43 microns.

Separated from the species by its slightly larger size and abruptly yellow third antennal segment.

Type-material.—Female holotype and one female paratype taken in 1929 (*R. E. Turner*) (*Moulton*, no. 5147).

Type-locality.—Matjesfontein, Cape Province, South Africa.

Æolothrips fasciatus Linn.

Eight specimens of this species were taken at Mossel Bay, Cape Province, and Katberg, East Cape Province, in April and October 1932 (*R. E. Turner*). This South African form is somewhat different from that found in Europe in that the spines along the posterior margin of the prothorax are stronger and the pronotum is more densely covered with small spines. These characters, however, are not distinctive enough to set it apart as a new variety.

Æolothrips africanus Moulton, sp. n.

Female holotype.—Colour dark chestnut-brown including legs and antenna, except the third segment which is yellow shading to very light brown at tip and fourth segment which is light brown at base shading to dark brown at tip; wings as in *fasciatus* Linn.

Total body-length 1.42 mm. Antennal segments, length (width): III. 93 (23); IV. 73 (23); V. 53; VI.-IX. 56 microns.

Male allotype.—Head, thorax, and tip of abdomen dark brown, abdomen otherwise light brownish yellow; first antennal segment lighter brown than head, 2 brownish yellow, 3 yellow, 4 yellow shading to light brown at tip, 5 to 9 brown; legs dark brown, tarsi lighter; wings as in the female with cross-bands.

This species is most closely related to *brevicornis* Bagnall, but separated by the longer third antennal segment, which is distinctly longer than 4, and by the longer style (VI.-IX.). In *brevicornis* the segments of the style are closely and evenly joined and together shorter than segment 5, while in this species they are clearly separated and the sides of VI.-VIII. are rounded.

This species can also be compared with *fasciatus* Linn., but is easily separated by its smaller size and more especially by the structure of the male, which has only very rudimentary clasping organs and is without thickened plates on the third and fourth tergites.

Type-material.—Female holotype, male allotype, and seven female and eight male paratypes, taken at Mossel Bay, May 1928 (*Moulton*, no. 5148), Somerset East (no. 5152), Matjesfontein (no. 5153), and Katberg (no. 5164), all in Cape Province, South Africa (*R. E. Turner*).

Type-locality.—Mossel Bay, Cape Province, South Africa.

Family Franklinothripidæ Bagnall.

Genus FRANKLINOTHIRIPS Bach.

Franklinothrips aureus Moulton, sp. n.

Female holotype.—Colour of head, most of middle and hind tibiæ, and antennal segments 5 to 9 abruptly dark brown; pterothorax and abdomen light yellow, slightly shaded with light brown and with orange and red pigment; prothorax intermediate in colour between head and pterothorax; first antennal segment somewhat lighter than head, 2 to 4 light brownish yellow; all femora light yellow shaded with brown on upper median margins, this brown more extensive on the

posterior legs; all tibiæ brown in basal portions and yellow at tips, tarsi yellow; fore wings mostly light brown with a clear cross-band at middle and another just before the end.

Total body-length 1.82 mm. Antennal segments, length (width): I. 44 (44); II. 50 (30); III. 411; IV. 543; V. 66; VI. 60; VII. 50; VIII. 46; IX. 20; total 1.250 mm.

This species has all of the characters of the genus, but may easily be separated by the exceedingly long fourth and fifth antennal segments. There are 3–7–10 spines on the fore vein of fore wing and 10–11 spines on hind vein.

Type-material.—Female holotype taken in June–July 1930 (*R. E. Turner*) (*Moulton*, no. 5146).

Type-locality.—Mossel Bay, Cape Province, South Africa.

Superfamily **THRIPOIDEA** Hood.

Family Thripidæ Uzel.

Subfamily *HELIOTHRIPINÆ* Karny.

Heliothrips pullus Moulton, sp. n.

Female holotype.—Colour blackish brown including first two antennal segments and all legs; third antennal segment brown at base, remainder of 3 also 4 and 5 clear yellow; 6 yellowish in basal half shading to brown in distal half; 7 and 8 brown; wings apparently clear.

Total body-length 1.22 mm. Antennal segments, length (width): II. 43 (36); III. 63 (18); IV. 46 (20); V. 46 (16); VI. 46 (16); VII. 10 (8); VIII. 43; total 313 microns.

This species was taken with *Heliothrips hæmorrhoidalis* Bouché, which it resembles closely in size and general appearance, except for the uniformly dark-coloured legs which is the distinctive character to separate the two species.

Type-material.—Female holotype and one female paratype collected in June 1930 (*R. E. Turner*) (*Moulton*, no. 5146).

Type-locality.—Mossel Bay, Cape Province, South Africa.

Heliothrips hæmorrhoidalis Bouché.

One specimen of this thrips was taken along with *H. pullus* at Mossel Bay, Cape Province (*R. E. Turner*) (*Moulton*, no. 5146).

Hercothrips bicinctus Bagnall.

Four specimens of this species were collected at Mossel Bay and Somerset East, Cape Province, in 1930 and 1931 (*R. E. Turner*) (*Moulton*, nos. 5146, 5151, 5152, and 5161).

Selenothrips glabratus Priesner.

Three female and three male specimens taken from the underside of coffee leaves at Bwamba, Uganda, in April 1926 (*H. Hargreaves*). The species was reported to be damaging coffee plants (*Moulton*, nos. 4380, 4383).

Subfamily *PANCHÆTOTHRIPINÆ* Bagnall.*Panchætothrips indicus* Bagnall.

One female and two male specimens taken from coffee leaves in Uganda, Africa, February 2, 1930 (*H. Hargreaves*) (*Moulton*, no. 4396).

Subfamily *CHIROTHRIPINÆ* Karny.*Chirothrips frontalis* Williams.

This is the second species of this genus reported as found in Africa. *C. frontalis* was first taken near Buenos Ayres, Argentine, and is now for the first time recorded from South Africa (*R. E. Turner*) (*Moulton*, nos. 5152, 5161).

Chirothrips manicatus Hal.

One specimen of this species taken December 23, 1930, at Somerset East, Cape Province (*R. E. Turner*) (*Moulton*, no. 5160).

Subfamily *SERICOTHRIPINÆ* Karny.*Pseudanaphothrips turneri* Moulton, sp. n.

Female holotype.—Colour uniformly brown with head, tip of antennal segments 2 and 5 to 8 darker; wings lightly washed with brown.

Total body-length .808 mm.; head, length .088 mm., width .14 mm.; prothorax, length .083 mm., width .150 mm.; pterothorax, width .166 mm. Antennal segments, length (width): II. 30 (20); III. 36 (16); IV. 33 (14); V. 30 (16); VI. 38 (16); VII. 6; VIII. 10; total 183 microns. Length of spines: interocellar and postoculars 13, on ninth abdominal segment 70, at tip 43 microns.

Front of head broadly rounded, slightly overhanging bases of antennæ, cheeks widening posteriorly where head is broadest; interocellar spines on either side placed on a line between anterior and posterior ocelli; back of head like pronotum and other parts of body faintly transversely striate. Prothorax broadly rounded at posterior angles; all spines weak, a series of six or seven on either side along posterior angles and margin, two at the angles somewhat stronger. Fore wings with spines on both longitudinal veins arranged in regular series, those near the tip spaced somewhat farther apart; fore vein with 3-16 and hind vein with fourteen spines. Spines on ninth abdominal segment longest, but these are still relatively short; spines at tip of abdomen much shorter. Posterior margin of eighth abdominal segment with complete comb; tenth segment with complete dorsal suture.

This species may be separated from *P. achætus* Bagnall by the darkened antennal segments except the first; in *achætus* 3 is yellowish brown, 4 and 5 a little darker. The ocelli are small in *turneri*, hardly larger than the facets of the eyes, and interocellar and postocular spines are present although small; in *achætus* the ocelli are larger and the interocellar and postocular spines wanting. Comb on eighth abdominal segment is complete in *turneri* and wanting in *achætus*.

Type-material.—Female holotype; taken in June 1930 (*R. E. Turner*) (*Moulton*, no. 5146). I take pleasure in naming this species after the collector.

Type-locality.—Mossel Bay, Cape Province, South Africa.

Subfamily *THEIPINÆ* Karny.

Bregmatothrips dimorphus Priesner.

In Priesner's monograph 'Die Thysanopteren Europas' he mentions that the wingless form of the female of this

species is unknown in Europe, although the male is without wings. Two specimens taken by Mr. Turner at Mossel Bay, Cape Province, in June 1930, are of especial interest, because both are females and without wings. One specimen is a normally coloured female with head and abdomen blackish brown, thorax lighter, and antennal segments 3 to 5 abruptly pale yellow. The second female specimen follows the normal colouring of the male with head and abdominal segments 3 to 10 blackish brown, prothorax yellowish brown, and pterothorax clear yellow; legs yellow with shadings of brown; antennal segments 3 to 5 abruptly pale yellow (*Moulton*, no. 5146).

Frankliniella africana Bagnall.

Fourteen female specimens of this species taken at Prince Albert Road and Somerset East by R. E. Turner in January and November 1931; also by H. B. Quinan at Somerset West in December 1931 (*Moulton*, nos. 4717, 5150, and 5151).

Isoneurothrips australis Bagnall.

Four female and two male specimens of this species hitherto known only from Australia and Japan were taken at Mossel Bay, Cape Province, in July 1930 (*R. E. Turner*) (*Moulton*, no. 5146).

Anaphothrips africanus Moulton, sp. n.

Female holotype.—Colour uniformly deep brown including legs except fore tibiae and all tarsi, which are light brown; wings light brown, veins darker; antennal segments 1, 2, except in outer portion where it is yellowish, distal half of 6, 7, and 8 dark brown; 3 to 5 and basal half of 6 light brownish yellow with a deeper shading of brown on distal margins of 4 and 5.

Total body-length .98 mm.; head, length .088 mm., width .15 mm.; prothorax .126 mm., width .183 mm.; pterothorax width .236 mm. Antennal segments, length (width): II. 26 (26); III. 30 (23); IV. 31 (22); V. 30 (20); VI. 40 (20); VII. 7; VIII. 13; total 183 microns. Longest spines on ninth abdominal segment 86 and on tenth 66 microns.

Head and prothorax without conspicuous spines; head flattened in front, cheeks slightly rounded; antennæ inserted underneath with forehead overhanging basal segments; ocelli larger than facets of eyes. Antennæ short and stout, twice as long as the short head. Fore wings with two longitudinal veins, the fore vein with a basal group of four or five spines, a middle group of four and with three spines scattered near tip; hind vein with eight spines which are more widely spaced in distal portion of wing. Eighth abdominal segment without a comb, tenth with complete dorsal suture.

A. africanus resembles *cuthbertsoni* Moulton from South Rhodesia in general appearance, but is distinctly separated by its darker colour and the placement of spines on the fore wings. These spines also are very much weaker in *cuthbertsoni* than in *africanus*. *Africanus* approaches *crassicornis* Moulton in the shape of the antenna. In *africanus* segment 6 has a distinct but incomplete suture, while in *crassicornis* this suture is complete.

Type-material.—Female holotype, two female paratypes taken December 10, 1930 (*R. E. Turner*) (*Moulton*, no. 5165).

Type-locality.—Somerset East, Cape Province, South Africa.

Limphysothrips aureus Moulton, sp. n.

Female holotype.—Head, prothorax, and abdomen deep brown with head darker and tenth abdominal segment blackish brown; pterothorax of a lighter golden-yellowish brown; legs, wings, and antennæ golden yellow except for a cloud of grey-brown on first two antennal segments, also at the tip of the fifth, distal half of the sixth, and the seventh and eighth.

Total body-length 1.75 mm.; head, length .16 mm., width .305 mm.; prothorax .19 mm., width .264 mm.; pterothorax width .338 mm. Antennal segments, length (width): III. 63 (26); IV. 56 (23); V. 43 (23); VI. 60 (23); VII. 13; VIII. 20; total length of antenna 306 microns. Length of spines: interocellar 66 microns; pair on posterior angles of prothorax subequal, 80 microns; longest spines on ninth abdominal segment 186, on tenth 123; spurs at tip 17 microns.

Head a little wider than long, slightly angular in front ; eyes semi-protruding especially at the sides, with coarse facets, some of the facets on margin and underneath larger than those on dorsal surface. Ocelli present, interocellar spines long. Antenna with eight segments, the sixth with an incomplete suture. Pronotum with two long spines on each posterior angle and a series of three on either side along posterior margin. Fore wings with two distinct longitudinal veins which are set regularly with spines, the fore vein with 3-17 and the hind vein with fifteen. Tenth abdominal segment almost tubular in shape and bearing two stout spurs near tip.

This species is very similar to the only other one in the genus, *L. paradoxus* Bagnall, but is separated by the clear, golden-yellow colour of the legs.

Type-material.—Female holotype taken in June 1930 from an unnamed host (*R. E. Turner*) (*Moulton*, no. 5146).

Type-locality.—Mossel Bay, Cape Province, South Africa.

Tæniothrips ugandai Moulton, sp. n.

Female holotype.—Colour deep chestnut-brown including legs except fore tibiæ, which are lighter, and all tarsi which are yellow ; antenna entirely dark, concolorous with head except segment 3 which is light brown ; fore wings uniformly brown except for an irregular lighter area near base ; hind wings light brown with a median darkened line extending to near tip.

Total body-length (abdomen distended) 2.03 mm. ; head, length .17 mm., width across eyes .176 mm., across cheeks .168 mm. ; prothorax, length .19 mm., width .235 mm. ; pterothorax, width .367 mm. Antennal segments, length (width): I. 33 (33) ; II. 46 (30) ; III. 66 (24) ; IV. 66 (25) ; V. 53 (20) ; VI. 73 (23) ; VII. 10 ; VIII. 13 ; total 323 microns. Length of spines : interocellar 16 microns, pair at posterior angles of prothorax 143, outer on ninth abdominal segment 160, inner 113, at tip of abdomen 136 microns.

Head approximately as long as wide, angular in front, with eyes strongly protruding, cheeks somewhat arched. Facets of eyes coarse, spines arising from eyes as strong as those on cheeks behind eyes ; ocelli large ; interocellar spines small and placed within the ocellar triangle on either side just behind anterior ocellus. Third and

fourth antennal segments ending rather broadly and not narrowed neck-like before the end; 7 and 8 very small, almost subequal. Pronotum with three spines on either side along posterior margin, the inner pair longest. Spines on posterior angles extremely long. Eighth abdominal segment with a complete comb; tenth segment with an incomplete dorsal suture. Legs slender, fore tarsi without claws. Fore vein of fore wing with 3-3 basal and eleven spines placed evenly in outer half; hind vein with fifteen spines.

Male allotype.—Coloured as in female. Total body-length 1.54 mm. With oval depressions on sternites 3 to 7 inclusive; ninth abdominal segment with an irregular grouping of three small spines on either side; tenth segment with two similar small spines placed close together near middle of segment.

The large size, small interocellar spines, and more numerous spines on distal portion of fore vein of fore wing separate this species from *T. major* Bagnall, the most closely related species.

Type-material.—Female holotype, male allotype, and one male paratype, taken from flowers of an unknown plant on December 25, 1926, at an elevation of 6000 feet (*G. L. R. Hancock*) (*Moulton*, no. 4384).

Type-locality.—Nkokonjera, Uganda.

Tæniothrips meridiana Moulton, sp. n.

Female holotype.—Colour dark chestnut-brown including all femora and middle and hind tibiae; fore tibiae and all tarsi yellowish brown; antennal segments 1 and 2 and 5 to 8 dark brown except extreme base of 5, which is lighter; 3 clear yellow with a shading of brown on upper margin, 4 clear yellow at base and yellowish brown in distal quarter, that portion which is narrowed neck-like, otherwise this segment is dark brown with a clear area at base and a lighter transverse banded area before the tip.

Total body-length (abdomen distended) 2.1 mm.; head, length .16 mm., width .176 mm.; prothorax, length .19 mm., width .26 mm.; pterothorax width .36 mm. Antennal segments, length (width): III. 80 (28); IV. 80 (26); V. 50 (20); VI. 63 (20); VII. 16; VIII. 20; total 330 microns. Length of spines: interocellar 76,

on posterior angles of prothorax 86–90, longest on ninth abdominal segment 190, at tip 186 microns. Median spines on anterior margin of metanotum placed closely together, 30 microns apart (20–23 on paratypes).

Interocellar spines long, placed midway on a line connecting the outer margins of anterior and posterior ocelli. Third and fourth antennal segments subequal in length and clearly constricted neck-like distally. A series of four spines on either side along posterior margin of pronotum, the inner pair longest. Fore vein of fore wing with three basal, followed by a series of eight to twelve spines, then an intermission, and two distal spines; hind vein with fifteen spines. Comb on ninth abdominal segment developed at the sides but wanting in the middle; dorsal suture on tenth segment extending only to base of terminal spines.

The distinctive characters which separate this species from *formosæ* Moulton are: the subequal third and fourth antennal segments, in *formosæ* the third is longer than the fourth; the much longer prominent spines; and the closely placed pair on anterior margin of metanotum, in *formosæ* these are 36–43 microns apart.

Male allotype.—Coloured as in female. Total body-length 1.33 mm. Sternites without noticeable depressions. Ninth abdominal segment with a long spine at each posterior angle, diagonally inward from the base of this spine on either side are two smaller spines, the first short and moderately stout, the second twice as long as the first and more slender; in addition there are two pairs of very short moderately stout spines, a median pair about one-fourth the distance from posterior margin and the second pair immediately on the posterior margin, one in the middle of each side. Fore vein of fore wing with three or four basal spines followed by seven extending to beyond middle of wing and two distal spines; hind vein with fourteen spines.

Type-material.—Female holotype, male allotype, one male and four female paratypes taken in flowers of "Kaymdindi," January 11, 1930 (*H. Hargreaves*) (*Moulton*, no. 4373). One female specimen, taken in cotton flowers October 20, 1929 (*H. Hargreaves*) (*Moulton*, no. 4393), is also assigned to this species but with some hesitancy.

Type-locality.—Kampala, Uganda.

Tæniothrips meridiana, form *tenuis* Moulton.

Female holotype.—Coloured as in the species, except that in the male the fore wings are almost uniformly brown, the light cross-band before the tip not apparent as in the female.

Total body-length of female 1.57 mm.; head, length .147 mm., width .16 mm.; prothorax, length .16 mm., width .19 mm.; pterothorax width .264 mm. Length of spines as in the species. Antennal segments, length (width): III. 63 (23); IV. 63 (23); V. 43 (16); VI. 63; VII. 16; VIII. 16 microns. It will be observed from the measurements that the form *tenuis* is smaller and more slender than the species, and antennal segments 3 and 4 while subequal are much smaller. Segment 6 is the same as in the species but of the same length as 3 and 4.

The greater distinction appears in the position of the spines on the ninth abdominal segment. The spines inward from the base of spines on posterior angles are placed to form a small triangle instead of on a diagonal line, and the two small spines on posterior margin are enlarged, are much stouter, and appear as small spurs.

Type-material.—Female holotype and male allotype taken in flowers of "Kayinchindi," January 1, 1925 (*H. Hargreaves*) (*Moulton*, no. 4397).

Type-locality.—Uganda.

Tæniothrips pura Moulton, sp. n.

Female holotype.—Colour light brownish yellow including legs; first antennal segment clear, 2 and 4 to 8 dark brown, 4 and 5 having a clear area at extreme base, segment 3 is brownish yellow; fore wings are washed with light greyish brown; prominent body spines brown; all tarsi with a black spot, tip of last abdominal segment blackened beyond the bases of terminal spines.

Total body-length 1.26 mm.; head, length .09 mm., width .146 mm.; prothorax, length .12 mm., width .186 mm.; pterothorax width .26 mm. Antennal segments, length (width): III. 43 (20); IV. 43 (18); V. 34 (16); VI. 43 (16); VII. 10; VIII. 13; total 233 microns. Length of spines: interocellar 33 microns; outer on posterior angles of prothorax 40; spines on

anterior margin of metanotum 40 microns long and placed 36 microns apart; longest spines on ninth abdominal segment 100 and at tip of abdomen 83 microns.

The head is distinctly transverse; interocellar spines small, placed 33 microns apart and in front of the posterior ocelli and on a line connecting their outer margins with the anterior ocellus. The third, fourth, and sixth antennal segments are of equal length, 3 and 4 are only slightly constricted distally. There are four spines on either side along posterior margin of pronotum. Fore vein of fore wing with a basal series, which ends before the middle of wing, of 6-6 spines, and a group of three distal spines; hind vein with 14-15 spines. Posterior margin of eighth abdominal segment without comb.

Male allotype coloured as in female; total body-length .74 mm. Sternites without depressions.

This species may be compared with *clarus* Moulton from Formosa, but is easily separated by the darkened antennal segments and the absence of comb on posterior margin of eighth abdominal segment.

Type-material.—Female holotype, male allotype, and two female paratypes taken in June 1930 (*R. E. Turner*) (*Moulton*, no. 5146).

Type-locality.—Mossel Bay, Cape Province, South Africa.

Tæniothrips quinani Moulton, sp. n.

Female holotype.—Body-colour dark brown; antennal segments I., II., and IV. to VIII. dark brown, II. darker than the others, III. light yellowish brown, lighter at base. Fore femora brown shading to yellowish in distal half, middle and hind femora brown in the middle, lighter, shading to yellow, at both ends; fore tibiae yellow with a slight shading of brown in the middle, middle and hind tibiae light brown in the middle shading to yellowish at both ends; all tarsi yellow. Fore wings clear in basal fifth, greyish brown beyond.

Total body-length 1.1 mm.; head, length .08 mm., width .140 mm.; prothorax, length .116 mm., width .170 mm. Antennal segments, length (width): II. 36 (23); III. 46 (20); IV. 43 (20); V. 30 (20); VI. 53; VII. 8; VIII. 10; total 253 microns. Length of spines: interocellar 10-12 microns; on posterior angles of prothorax, outer 40, inner 50; median spines on metathorax

13 microns apart and placed 16 microns from anterior margin; on ninth abdominal segment 90, on tenth 83 microns.

Head is distinctly transverse; ocelli somewhat larger than facets of eyes; antennal segments (3 and 4) about equal, with 3 only a little longer than 4; segment 5 unusually short, 6 longest of all; 7 and 8 about subequal and very small. Posterior margin of pronotum with six spines; the inner spine at each posterior angle is somewhat longer than the outer. The median spines on metanotum are placed close together but well back from the anterior margin. Fore vein of fore wing with spines grouped as follows: a basal group of three or four followed by a short intermission, then a second group of four to six, which end before the middle of the wing. A distal group of eight to ten spines begins after the larger intermission in the middle of the wing and extends to tip. Comb on posterior margin of eighth abdominal segment is complete.

Male allotype.—With body, legs, and wings coloured clear yellow; first antennal segment clear, 2 darker yellow, 3 light greyish brown, 4 to 8 brown. Total body-length 1.01 mm. Wings with spines as in female. Abdomen without ventral depressions. Ninth abdominal segment with a group of three slender spines on either side, no spurs present.

This species is most closely related to *T. simplex* Morison (*T. gladioli* Moulton & S. is a synonym of this species) but is easily separated by its smaller size, shorter antennal segments, and shorter spines. *Quinani* is also separated from *fumosa* Trybom by the lighter third antennal segment and lighter coloured legs as well as the lighter base of fore wings.

Type-material.—Female holotype, male allotype, twenty female and five male paratypes taken from the late bloom of Hanab Turki vine, December 28, 1931, at Somerset West, Cape Province (*K. B. Quinan*) (*Moulton*, no. 4714); from an unknown host plant at Mossel Bay, Cape Province, in June 1930 (*R. E. Turner*) (*Moulton*, nos. 5146, 5143, and 5155).

Type-locality.—Somerset West, Cape Province, South Africa. This species is named after Mr. K. B. Quinan, one of the collectors.

Tæniothrips incerta Moulton, sp. n.

Female holotype.—Colour deep chestnut-brown; all femora like body but lighter at bases and tips, fore femora yellowish distally; fore tibiæ and all tarsi yellowish brown, middle and hind tibiæ yellowish at either end. Antennal segments like head with 2 lighter in median outer portion; 3 to 5 light brownish yellow, 6 a little darker, 7 and 8 brown. Fore wings washed with brown but lighter in basal fifth.

Total body-length 1.47 mm.; head, length .117 mm., width .176 mm.; prothorax, length .176 mm., width .26 mm.; pterothorax width .30 mm. Antennal segments length (width): II. 30 (30); III. 40 (26); IV. 40 (24); V. 43 (23); VI. 56 (23); VII. 12; VIII. 16; total 256 microns. Length of spines: interocellar 60, pair at posterior angles of pronotum, outer 76, inner 83; short stout spines near anterior margin of ninth abdominal segment 50, near posterior angles 133, near tip of tenth 86 microns.

Head slightly produced but rounded in front of eyes. Eyes large, facets coarse, ocelli about as large as facets of eyes. Interocellar spines long and stout, placed midway on a line connecting anterior with posterior ocelli. Antennal segments short and relatively broad, segment 3 being about 1.5 longer than wide, 3 to 6 are pediculate; segment 8 is longer than 7. Fore femora noticeably enlarged, fore tarsus without tooth. Pronotum with three spines on either side along posterior margin, pair at posterior angles long and strong. Fore vein of fore wing with three or four basal spines followed immediately by another group of three; after a small intermission there follows a series of 9–12 spines which extend to tip of wing; the intermission separating the basal and distal groups is before the middle of the wing and hardly preceptible in some paratypes; hind vein with 12–13 spines. Comb wanting on posterior margin of eighth abdominal segment. Ninth segment with a single, short, stout spine on either side near anterior margin; other prominent spines on this segment much longer than those at tip of tenth. Tenth segment with a complete dorsal suture.

Male allotype.—Coloured as in female. Total body-length 1.0 mm. Sternites without ventral depressions.

Ninth abdominal segment with a pair of short, stout, median spurs arising from small tubercles.

This species is most closely related to *T. firmus* Uzel but is easily separated by the more compact antennal segments and the lighter colour of segments 4 to 6. Some of the paratypes could easily be mistaken, because of the apparent continuous row of spines on fore vein of fore wing, and placed in the genus *Isochætothrips* Moulton, but a close examination usually clarifies this. The row of spines in this latter genus are more numerous and closely placed.

Type-material.—Female holotype, male allotype, one male and two female paratypes taken in June 1930, from an unknown host (*R. E. Turner*) (*Moulton*, no. 5146).

Type-locality.—Mossel Bay, Cape Province, South Africa.

LIII.—*The Disparoneura-complex: Generic Characters and Lists of Species (Odonata)*. By J. COWLEY, F.R.E.S.

IN two previous papers (references to which are given under the generic names below) I have dealt with the unfortunate early, and constant, misuse in the *nomenclature* of certain generic names of Protoneuridæ, of which *Disparoneura* is an important member; for convenience I therefore called the whole problem the *Disparoneura*-complex. The present paper is an attempt to define the characters of these genera, with the addition of an alphabetical index to the species, as there has also been much confusion in the taxonomy of the complex, though in recent years, thanks to the work of Fraser, Laidlaw, and Lieftinck, the majority of the species have been relegated to their proper genera. The genus *Chlorocnemis* (although probably not a member of the Protoneuridæ), together with another genus formed from it, is also included, since some species described as *Disparoneura* must be removed to the former genus. This study has been based on all the original and subsequent specific and generic descriptions and such specimens as were available in the British Museum, the Cambridge University Museum of Zoology, and in my own collection, and

on a number of wing-photographs; Mr. M. A. Lieftinck very kindly sent me details of new unpublished synonymies, which are noted below as due to him. I also gratefully acknowledge assistance rendered by the following:—Monsieur A. Ball (wing-photographs of types of *Disparoneura glauca* Selys and *D. subnodalis* Selys, in the Brussels Museum); Dr. K. H. Barnard (note on *D. frenulata* Selys); Señor F. Bonet (loan of types of *D. oculata* Mart. and *D. agrioniformis* Mart., in the Madrid Museum); Mrs. L. K. Gloyd (wing-photograph and sketch of type of *Chlorocnemis cyanura* Först., in Mus. Zool. Univ. Michigan); Mr. G. J. Kerrich (Univ. Mus. Zool. Cambridge); Mr. D. E. Kimmins (British Museum, and wing photographs of *C. elongata* Selys and *D. dorsalis* Selys); Mr. M. A. Lieftinck (notes on new synonymies); Professor J. G. Needham (loan of wings of type of *Indoneura dolorosa* Needh., in Cornell Univ. Coll.); and the authorities of the United States National Museum (wing-photograph of type of *D. abbotti* Calv.).

It is very probable that some of the genera discussed below could, on a careful study and tabulation of the very reduced venation, be split up into distinct groups, possibly of generic value; but I have not attempted such an extensive study here, as I have seen relatively few of the described species and but few specimens of each. Subspecies have throughout been treated as species, as a matter of convenience rather than as a systematic opinion.

The genera discussed below all possess the following general characters, which will not be repeated under each genus; the key is not intended to express any phylogenetic or systematic opinions, but merely as an aid to the proper assignment of the species. To avoid ambiguity the Selysian vein terminology is used.

General Characters.—Zygoptera with only two antenodal cross-veins; wings petioled; no supplementary longitudinal veins between the main veins; the subnodal and median sectors arising very much nearer the nodus than the arculus; quadrilateral rectangular in shape, never crossed, elongated in the longitudinal axis of the wing; the cross-veins arranged to form a series of transversals; the superior sector of the triangle reduced in length; the inferior sector of the triangle reduced

or absent, never extending more than two cells beyond the distal end of the quadrilateral (when it extends two cells beyond the quadrilateral then the subnodal sector arises distal to the subnodus; when it is absent and the basal postcostal cross-vein is close to the level of the first antenodal then the median sector arises proximal to the subnodus and the subnodal sector at the subnodus, and the superior sector of the triangle does not extend beyond the level of the nodus); no additional cross-vein basal to the normal postcostal cross-vein; the median sector arising proximal to or at the subnodus, never distal to it; labium with short lobes.

Artificial Key to the Genera of the Disparoneura-complex.

- | | | |
|--------|--|-------------------------|
| 1. | Inferior sector of triangle present..... | 2. |
| | Inferior sector of triangle absent | 9. |
| 2. | Inferior sector of triangle extending beyond level of distal end of quadrilateral | <i>Chlorocnemis</i> . |
| | Inferior sector of triangle not extending beyond level of distal end of quadrilateral. | 3. |
| 3. | Inferior sector of triangle ending at cross-vein descending from distal side of quadrilateral..... | 4. |
| | Inferior sector of triangle not reaching cross-vein descending from distal side of quadrilateral | 8. |
| 4. | Median sector arising at subnodus, subnodal sector arising half a cell distal to subnodus. | [gen. nov.] |
| | Median sector arising proximal to subnodus, subnodal sector arising at, or very slightly (never as much as half a cell) distal to, subnodus | <i>Isomecrocnemis</i> , |
| | | 5. |
| 5. | Posterior lobe of prothorax of female armed with specialized hooks; 10-21 postnodals in fore wing; superior sector of triangle in fore wing extending 0-6 cells beyond level of nodus..... | 6. |
| | Posterior lobe of prothorax of female simple, rounded; 19-31 postnodals in fore wing; superior sector of triangle in fore wing extending 6-11 cells beyond level of nodus. | 7. |
| 6. | Superior sector of triangle in fore wing extending 5-6 cells beyond level of nodus; wings of male tipped or barred with black. | <i>Disparoneura</i> . |
| | Superior sector of triangle in fore wing extending 0-6 cells beyond level of nodus; wings of male hyaline | <i>Elattoneura</i> . |
| 7 (5). | 27-31 postnodals in fore wing; superior sector of triangle in fore wing extending about 11 cells beyond level of nodus | <i>Phylloneura</i> . |
| | 19-23 postnodals in fore wing; superior sector of triangle in fore wing extending about 6 cells beyond level of nodus..... | <i>Esmec</i> . |

- 8 (3). Posterior lobe of prothorax of female armed with specialized hooks; 12-18 postnodals in fore wing; superior sector of triangle ending before, or extending 0-3 cells beyond, level of nodus..... *Prodasineura*.
 Posterior lobe of prothorax of female simple, rounded; 20-26 postnodals in fore wing; superior sector of triangle extending 6-7 cells beyond level of nodus..... *Caconeura*.
- 9 (1). Basal postcostal cross-vein proximal to, at, or very slightly distal to, level of first antenodal, never approaching mid-point between antenodals; superior sector of triangle not extending beyond level of nodus..... *Notoneura*.
 Basal postcostal cross-vein about midway between first and second antenodals; superior sector of triangle usually extending beyond level of nodus..... 10.
10. Posterior lobe of prothorax of female armed with specialized hooks; 12-18 postnodals in fore wing; superior sector of triangle in fore wing ending before, or extending 0-3 cells beyond, level of nodus..... *Prodasineura*.
 Posterior lobe of prothorax of female simple, rounded; 19-22 postnodals in fore wing; superior sector of triangle extending 3-5 cells beyond level of nodus..... *Melanoneura*.

CHLOROCNEMIS Selys, 1863. (Figs. 1 & 2.)

Genotype: *Chlorocnemis elongata* Selys, 1863. (Fig. 1.)

Chlorocnemis Selys, 1863. Bull. Acad. Belg. (2) xvi. p. 175; 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 140; Munz, 1919, Mem. Amer. Ent. Soc. iii. p. 63; Ris, 1921, Ann. S. Afr. Mus. xviii. p. 266.

Characters.—Wings petioled to or beyond the basal postcostal cross-vein, which is nearer the first than the second antenodal, or under the first; postnodals, fore wing 11-17, hind wing 11-14; median sector arising proximal to or at the subnodus; subnodal sector arising distal to the subnodus; superior sector of the triangle extending beyond the level of the nodus $3\frac{1}{2}$ -9 cells fore wing, $3\frac{1}{2}$ -10 cells hind wing; inferior sector of the triangle extending beyond the quadrilateral 1 cell in fore wing, 1-2 cells in hind-wing; wings hyaline or uniformly yellow.

Includes the following species:—*abbotti* Calv., *elongata* Selys (fig. 1), *flavipennis* Selys, *gestroi* Mart., *inepta* Grünb., *marshalli* Ris, *nigripes* Selys, *nubilipennis* Karsch, *williamsoni* Mart. (fig. 2).

C. cyanura Först. is removed to *Isomecognemis*.

Disparoneura abbotti Calv., as is evident from the original description and from photographs of the type, is a *Chlorocnemis*, as has already been pointed out by Grünberg (1902, S.B. Ges. naturf. Fr. Berl. 1902, p. 233; 1903, Zool. Jahrb., Syst. xviii. p. 705). I have examined

Fig. 1.

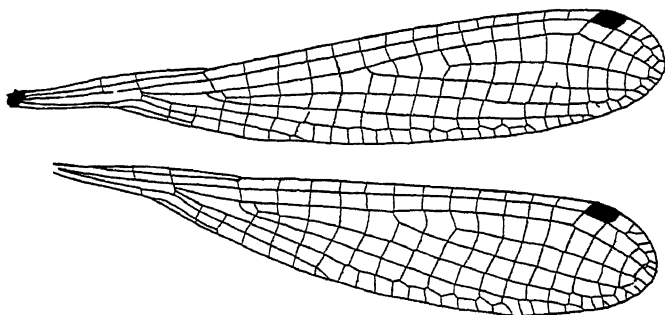


Fig. 2.

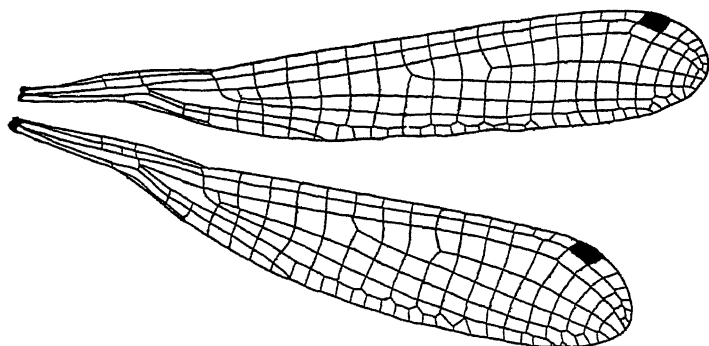


Fig. 1.—*Chlorocnemis elongata* Selys, ♂. (British Museum, from photograph by Mr. D. E. Kimmins.)

Fig. 2.—*Chlorocnemis williamsoni* Martin, ♂. (Type in Madrid Museum. Original.)

the type of *Disparoneura oculata* Mart. (*williamsoni* Mart., nom. nov.); it is a *Chlorocnemis*, possibly a synonym of *C. nigripes* Selys, from the description of which it only differs in having no pale dorsal stripe on abdominal segment 5; an examination of the type of *C. nigripes* should settle this point.

The systematic position of this genus (and of *Isomeconem*) is uncertain, as the venation appears to be intermediate between that of the *Platycnemididæ* and *Protoneuridæ*; originally placed by Selys in the legion *Platycnemis*, he later (1889, Ann. Soc. ent. Belg. xxxiii., C. R. clxxiii.) removed it to the legion *Protoneura*; Tillyard (1917, Biol. Dragonflies, p. 279) placed it in the *Platycneminae*, Munz (1919, Mem. Amer. Ent. Soc. iii. p. 25) in the *Protoneurinae*, Kennedy (1920, Ohio J. Sci. xxi. p. 27) in the *Platycneminae*, adding that the penes of this latter subfamily do not indicate any close relationship to the *Protoneurinae*; the question of the systematic position of *Chlorocnemis* might be solved in a study of the relationship of these two groups. Considering the reduction-series *Allocnemis-Chlorocnemis-Isomeconem*, and that the subnodal sector and the lower sector of the arculus, becoming angulate more distally, have an appearance more *Platycnemidine* than *Protoneurine*, I am inclined to place these two genera in the *Platycnemididæ*.

ISMECOCNEMIS, gen. nov. (Figs. 3 & 4.)

Genotype: *Chlorocnemis cyanura* Förster, 1909. (Fig. 3.)

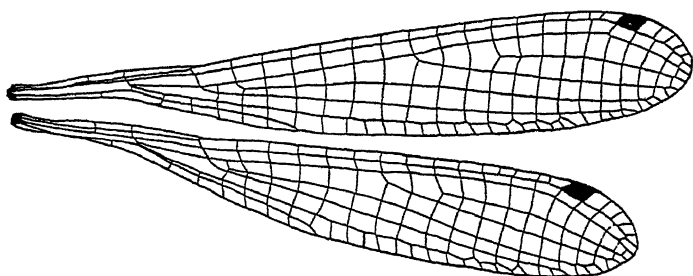
Disparoneura (div. 1, gr. 1) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4), p. 161.

Characters.—Wings petioled to beyond the basal post-costal cross-vein, which is nearer the first than the second antenodal; postnodals, fore wing 14–15, hind wing 11–14; median sector arising at the subnodus; subnodal sector arising distal to the subnodus; superior sector of the triangle extending beyond the level of the nodus 4–5 cells fore wing, 5–6 cells hind wing; the inferior sector of the triangle not extending beyond the level of the distal side of the quadrilateral, but ending at the cross-vein descending from it; wings hyaline.

Includes the following species:—*cyanura* Först. (fig. 3), *subnodalis* Selys (fig. 4); possibly also *cellularis* Grünb. Differs as follows from *Chlorocnemis* (characters in order of importance): inferior sector of the triangle not extending beyond the quadrilateral, the median sector at its origin straighter, tending to lie in the longitudinal wing-axis (in *Chlorocnemis* the origin tends more to the

transverse axis, and the curvature is consequently greater), the first postquadrangular cell longer, ending nearer the nodus, the wings longer and narrower.

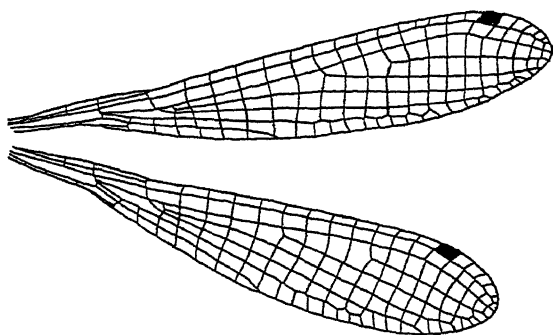
Fig. 3.



Isomecocnemis cyanura Förster, ♂. (Type in Mus Zool. Univ. Michigan, from photograph by Miss Dorothy Myers.)

Note.—In the fore wing figured the origin of the subnodal sector is abnormal; in the left fore wing it arises normally at a point corresponding to the cross-vein between the origins of the subnodal and median sectors of the fore wing figured. The inferior sector of the triangle appears to be absent owing to the buckling of the wings.

Fig. 4.



Isomecocnemis subnodalis Selys, ♂. (Type in Brussels Museum.)

Derivation.—*ἰσομήκης*, equal in length (inferior sector of triangle and quadrilateral), *-cnemis*, group-ending to indicate affinity.

This genus is erected for the reception of *Chlorocnemis cyanura* Först. I believe *Disparoneura subnodalis* Selys also belongs here; if it were retained in the Proto-

neuridæ the more distal origins of the median and subnodal sectors would necessitate its separation from *Elattonneura* as a new genus; but it has the less angulate longitudinal veins of a Platycnemidine; Grünberg (1903, Zool. Jahr., Syst. xviii. p. 707) suggested it should either be placed in *Chlorocnemis* or in a new genus between *Disparoneura* (*Elattonneura*) and *Chlorocnemis*. *Disparoneura cellularis* Grünb. should, perhaps, be transferred to this genus.

PHYLLONEURA Fraser, 1922.

Genotype: *Alloneura westermanni* Selys, 1860.

Alloneura (gr. 1, § 1) Selys, 1860, Bull. Acad. Belg. (2) x. p. 447.

Disparoneura (div. 2, gr. 2, B (pars)) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 161.

Phylloneura Fraser, 1922, Rec. Indian Mus. xxiv. p. 3; 1933, Fauna Brit. India, Odon. i. p. 268.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals, fore wing 27–31, hind wing 26–27; median sector arising proximal to the subnodus; subnodal sector arising at the subnodus; superior sector of the triangle extending beyond the level of the nodus 11 cells fore wing, 13 cells hind wing; inferior sector of the triangle ending at the cross-vein descending from the distal side of the quadrilateral; wings hyaline; posterior lobe of prothorax of female simple, rounded.

The only species is *westermanni* Selys; the venation has been figured by Fraser, 1933, *op. cit.* fig. 115.

ESME Fraser, 1922.

Genotype: *Esme cyaneovittata* Fraser, 1922.

Esme Fraser, 1922, Mem. Dep. Agric. India, Ent. vii. p. 44; 1933, Fauna Brit. India, Odon. i. p. 262.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals, fore wing 19–23, hind wing 18–21; median sector arising proximal to the subnodus; subnodal sector arising at the subnodus; superior sector of the triangle extending 6 cells beyond the level of the nodus; inferior sector of the triangle ending at the cross-vein descending from the distal side of the quadrilateral; wings hyaline; posterior lobe of prothorax of female simple, rounded.

Includes the following species:—*cyaneovittata* Fras., *longistyla* Fras., *mudiensis* Fras.; the venation of the genotype has been figured by Fraser, 1933, *op. cit.* fig. 111.

DISPARONEURA Selys, 1860.

Genotype: *Argia quadrimaculata* Rambur, 1842.

Disparoneura (gr. 2) Selys, 1860, Bull. Acad. Belg. (2) x. p. 445.

Disparoneura Selys, 1865, Bull. Acad. Belg. (2) xx. p. 379.

Disparoneura (div. 2, gr. 2, A) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 161.

Chloroneura Laidlaw, 1917, Rec. Indian Mus. xiii. p. 343; 1920, Proc. Zool. Soc. Lond. p. 338; Fraser, 1933, Fauna Brit. India, Odon. 1. p. 244.

Disparoneura Cowley, 1934, Entomologist, lxxvii. p. 203.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals, fore wing 14–16, hind wing 12–14; median sector arising proximal to the subnodus; subnodal sector arising at the subnodus; superior sector of the triangle extending beyond the level of the nodus 5–6 cells fore wing, 6 cells hind wing; inferior sector of the triangle ending at the cross-vein descending from the distal side of the quadrilateral; wings of male tipped or barred with black; posterior lobe of prothorax of female armed with specialized hooks.

Includes the following species:—*apicalis* Fras., *quadrimaculata* Ramb.; the venation of *apicalis* has been figured by Fraser, 1933, *op. cit.* fig. 102.

ELATTONEURA Cowley, 1935.

Genotype: *Disparoneura glauca* Selys, 1860.

Disparoneura (gr. 1) Selys, 1860, Bull. Acad. Belg. (2) x. p. 443.

Alloneura (gr. 2; gr. 3, § 1) Selys, 1860, Bull. Acad. Belg. (2) x. pp. 448, 451.

Disparoneura (div. 2, gr. 2, B (pars)) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 161.

Disparoneura (pars) Ris, 1912, Tijdschr. Ent. iv. p. 161.

Disparoneura (pars) Laidlaw, 1913, Proc. Zool. Soc. Lond. p. 74.

Disparoneura Laidlaw, 1917, Rec. Indian Mus. xiii. p. 344; 1920, Proc. Zool. Soc. Lond. p. 338; Ris, 1921, Ann. S. Afr. Mus. xviii. p. 266; Laidlaw, 1924, Spolia Zeylan. xii. p. 367; Fraser, 1933, Fauna Brit. India, Odon. 1. p. 228.

Elatoneura Cowley, 1935, Ent. Mon. Mag. lxxi. p. 14.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals, 10–21 fore wing, 9–19 hind wing; median sector arising proximal to the subnodus; subnodal sector arising

at or slightly distal to the subnodus; superior sector of the triangle in the fore wing ending at the level of the nodus, or extending 1-6 cells beyond it, in the hind wing extending 1-7 cells beyond it; inferior sector of the triangle ending at the cross-vein descending from the distal side of the quadrilateral; wings hyaline; posterior lobe of prothorax of female armed with specialized hooks. The venation of *mutata* (?=*glauc*a) has been figured by Ris, 1921, Ann. S. Afr. Mus. xviii. pl. vii. fig. 9.

Includes the following species:—*alba* Först., *anal*is Selys, *atkinsoni* Selys, *aurantiaca* Selys, *cacharensis* Fras., *cæsia* Selys, *campioni* Fras., *centralis* Selys, *frenulata* Selys, *glauc*a Selys, *leucostigma* Fras., *nigerrima* Laidl., *pruinosa* Selys, *simba* Mart., *souteri* Fras., *tenax* Selys, *tetrica* Laidl.

Dr. K. H. Barnard informs me that *E. frenulata* Selys has been rediscovered in South Africa and that both sexes are easily distinguished from *E. mutata* Selys (sensu Ris, 1921, Ann. S. Afr. Mus. xviii. pp. 293, 439); this latter species is possibly a synonym of *glauc*a, as suggested by Ris himself (1921, *loc. cit.*), in which case *glauc*a is the prior name, as it is not a homonym, as Ris thought (Cowley, 1935, Ent. Mon. Mag. lxxi. p. 14).

Disparoneura subnodalis Selys has been removed to *Isomecocrnemis*; *D. abboti* Calv. and *D. williamsoni* Mart. to *Chlorocrnemis*; *williamsoni* was proposed as a new name for *D. oculata* Mart., a primary homonym of *D. oculata* Kirby (= *E. centralis* Selys). *D. cellularis* Grünb. is referred with some doubt to *Isomecocrnemis*.

CACONEURA Kirby, 1890.

Genotype: *Argia gomphoides* Rambur, 1842.

Alloneura (gr. 1, § 2) Selys, 1860, Bull. Acad. Belg. (2) x. p. 448.

Alloneura Selys, 1865, Bull. Acad. Belg. (2) xx. p. 379.

Disparoneura (div. 2, gr. 3, A) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 161.

Caconeura Kirby, 1890, Syn. Cat. Neuropt. Odon. p. 134 (new name).

Indoneura Selys, 1917, Rec. Indian Mus. xiii. p. 344.

Hypostrophoneura Munz, 1919, Mem. Amer. Ent. Soc. iii. p. 64.

Indoneura Laidlaw, 1920, Proc. Zool. Soc. Lond. p. 338; Fraser, 1933, Fauna Brit. India, Odon. i. p. 250.

Caconeura Cowley, 1934, Entomologist lxxvii. p. 203.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals,

20–26 fore wing, 17–21 hind-wing ; median sector arising proximal to the subnodus ; subnodal sector arising at the subnodus ; superior sector of the triangle extending beyond the nodus 6–7 cells fore wing, 8 cells hind wing ; inferior sector of the triangle ending on the posterior wing-margin proximal to the cross-vein descending from the distal side of the quadrilateral ; wings hyaline ; posterior lobe of prothorax of female simple, rounded. The venation of *ramburi* Fras. has been figured by Fraser, 1933, *op. cit.* fig. 104.

Includes the following species :—*gomphoides* Ramb., *obscura* Fras., *ramburi* Fras., *risi* Fras., *t-cæruleum* Fras.

Indoneura dolorosa Needh. has been removed to *Prodasineura*.

MELANONEURA Fraser, 1922.

Genotype : *Melanoneura bilineata* Fraser, 1922.

Melanoneura Fraser, 1922, Mem. Dep. Agric. India, Ent. vii. p. 55 ; 1933, Fauna Brit. India, Odon. i. p. 259.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals ; postnodals, 19–22 fore wing, 17–20 hind wing ; median sector arising proximal to the subnodus ; subnodal sector arising at or slightly distal to the subnodus ; superior sector of the triangle extending beyond the level of the nodus 3–5 cells fore wing, 3–4 cells hind wing ; inferior sector of the triangle absent ; wings hyaline ; posterior lobe of prothorax of female simple, rounded.

The only species is *bilineata* Fras. ; the venation has been figured by Fraser, 1933, *op. cit.* fig. 109.

PRODASINEURA Cowley, 1934. (Figs. 5 & 6.)

Genotype : *Alloneura dorsalis* Selys, 1860. (Fig. 5.)

Alloneura (gr. 3, § 2, 3) Selys, 1860, Bull. Acad. Belg. (2) x. pp. 452, 456.

Disparoneura (div. 2, gr. 3, B, C, D) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 162.

Alloneura (gr. 1, A, B) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 177.

Caconeura Kirby, 1890, Syn. Cat. Neuropt. Odon. p. 134.

Disparoneura (pars) Ris, 1912, Tijdschr. Ent. lv. p. 161.

Disparoneura (pars) Laidlaw, 1913, Proc. Zool. Soc. Lond. p. 74.

Caconeura Laidlaw, 1917, Rec. Indian Mus. xiii. p. 344.

Disparoneura Munz, 1919, Mem. Amer. Ent. Soc. iii. p. 64.

Caconeura Laidlaw, 1920, Proc. Zool. Soc. Lond. p. 338; 1924,

Spolia Zeylan. xii. p. 367.

Indoneura Needham, 1930, Zool. Sinica, A, xi. (1) p. 283.

Disparoneura Needham, 1930, Zool. Sinica, A, xi. (1) p. 284.

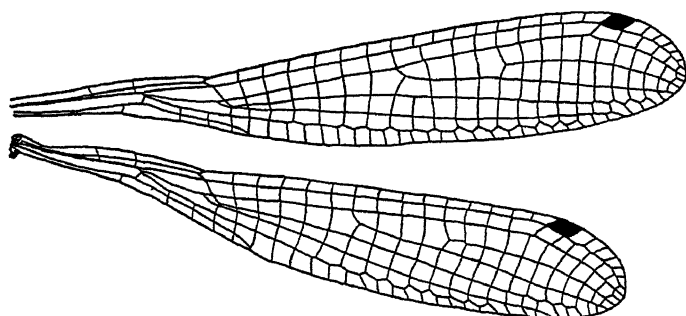
Caconeura Fraser, 1933, Fauna Brit. India, Odon. i. p. 210.

Cycloneura Fraser, 1933, Fauna Brit. India, Odon. i. p. 212.

Prodasineura Cowley, 1934, Entomologist, lxvii. pp. 202, 203; 1935, Ent. Mon. Mag. lxxi. p. 15.

Characters.—Basal postcostal cross-vein between the levels of the first and second antenodals; postnodals, 12–18 fore wing, 11–15 hind wing; median sector arising proximal to the subnodus; subnodal sector arising at or slightly distal to the subnodus; superior sector

Fig. 5.



Prodasineura dorsalis Selys, ♂. (British Museum, from photograph by Mr. D. E. Kimmins.)

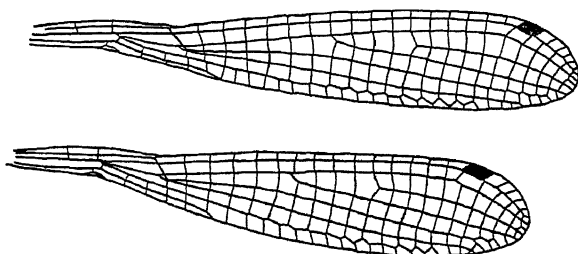
of the triangle in the fore wing ending one cell proximal to, at the level of, or 1–4 cells distal to the nodus, in the hind wing ending at the level of or 1–3 cells distal to the nodus; inferior sector of the triangle ending on the posterior margin of the wing proximal to the cross-vein descending from the distal side of the quadrilateral, or absent; wings hyaline; posterior lobe of prothorax of female armed with specialized hooks.

Includes the following species:—*andamanensis* Fras., *annandalei* Fras., *autumnalis* Fras., *botti* Fras., *burmanensis* Fras., *collaris* Selys, *cærulescens* Fras., *croconota* Ris, *delia* Karsch, *delicatula* Lieft., *dohrni* Krüg., *dorsalis* Selys (fig. 5), *gracillima* Selys, *hosei* Laidl., *humeralis*

Selys, *hyperythra* Selys, *integra* Selys, *interrupta* Selys, *laidlawii* Först., *lansbergei* Selys, *nigra* Fras., *notostigma* Selys, *obsoleta* Selys, *o'doneli* Fras., *peramaena* Laidl., *sita* Kirby, *theebawi* Fras., *verticalis* Selys, *vittata* Selys.

Indoneura dolorosa Needh. belongs here, and, from a series from China in my collection, is a synonym of *autumnalis* Fras. I have seen the type of *Disparoneura agrioniformis* Martin (fig. 6): even at the time of Martin's description it was scarcely in a fit state of preservation to be named, being a badly crushed teneral specimen; it is at least a *Prodasineura*, and what details can be made out agree with the description of *P. vittata* Selys, of which latter species I consider *agrioniformis* to be a synonym;

Fig. 6.



Prodasineura vittata Selys. ♂. (Type of *D. agrioniformis* Martin, in Madrid Museum. Original.)

P. vittata is in the anomalous position of being the only African species of an otherwise exclusively Asiatic genus.

Mr. Lieftinck informs me that *Caconeura auricolor* Fras. is a synonym of *P. croconota* Ris.

NOTONEURA Tillyard, 1913.

Genotype: *Alloneura solitaria* Tillyard, 1906.

Alloneura (gr. 2) Selys, 1886, Mém. cour. Acad. Belg. xxxviii. (4) p. 177.

Caconeura Ris, 1912, Tijdschr. Ent. iv. p. 161; 1913, Abh. senckenb naturf. Ges. xxxiv. p. 508.

Notoneura Tillyard, 1913, Proc. Linn. Soc. N.S.W. xxxvii. p. 430; Muz, 1919, Mem. Amer. Ent. Soc. iii. p. 66.

Risoneura Munz, 1919, Mem. Amer. Ent. Soc. iii. p. 66; Laidlaw, 1920, Proc. Zool. Soc. Lond. p. 338.
Notoneura Lieftinck, 1932, Nova Guinea, xv. p. 519.

Characters.—Basal postcostal cross-vein slightly proximal to, at the level of, or very slightly distal to the first antenodal, never noticeably between the levels of the two antenodals; postnodals, 9–18 fore wing, 9–14 hind wing; median sector arising proximal to the subnodus; subnodal sector arising at the subnodus; superior sector of the triangle not extending more than one cell (rarely two cells in the hind wing) distal to the quadrilateral; inferior sector of the triangle absent; wings hyaline. The venation of the genotype has been figured by Munz, 1919, *loc. cit.* fig. 141.

I divide the genus into three groups, as follows:—

1. *solitaria*-group: tarsal claws with a well-developed interior tooth; a transverse cross-vein descending from the distal side of the quadrilateral to the wing-margin. Includes *astrolabica* Först., *chalybeostoma* Lieft., *cyanura* Lieft., *eburnea* Först., *erythroprocta* Selys, *fonticola* Lieft., *moluccensis* Selys, *nigrifrons* Ris, *nigrofasciata* Lieft., *plagiata* Selys, *plagiozantha* Lieft., *pseudexul* Ris, *rosea* Ris, *salomonis* Selys, *solitaria* Till., *wallacii* Selys, *xanthomelæna* Ris; probably also *flavipennis* Selys and *insignis* Selys.

2. *exul*-group: tarsal claws with a well-developed interior tooth; no transverse cross-vein descending from the distal side of the quadrilateral to the wing-margin. Includes *circumscripta* Selys, *exul* Selys, *finisterræ* Först., *marina* Ris.

3. *erythrura*-group: tarsal claws without any interior tooth; a transverse cross-vein descending from the distal side of the quadrilateral to the wing-margin (rarely absent). Only *erythrura* Lieft.

The following species, which I do not know sufficiently well to place in any of the above groups, are also placed in *Notoneura*:—*cælestina* Till., *dorsonigra* Mart., *fraterna* Lieft., *phœnissa* Ris, *selysii* Först.

Mr. Lieftinck has informed me of the following new synonymies:—*cruentata* Lieft.=*rosea* Ris, *geminata* Fras.=*eburnea* Först., *torrenticola* Först.=*astrolabica* Först.

Alphabetical Index to the Species.

In the first column are given the original generic and specific names, in the second the names used in the present paper.

- abbotti* Calvert, 1892, *Disparoneura*.
agrioniformis Martin, 1907, *Disparoneura*.
alba Förster, 1906, *Disparoneura*.
analisis Selys, 1860, *Alloneura*.
andamanensis Fraser, 1924, *Caconeura*.
annandalei Fraser, 1921, *Caconeura*.
apicalis Fraser, 1924, *Chloroneura*.
arba Krüger, 1898, *Disparoneura*.
arba Ris, 1927, *Disparoneura*.
astrolabica Förster, 1898, *Caconeura*.
atkinsoni Selys, 1886, *Disparoneura*.
aurantiaca Selys, 1886, *Disparoneura*.
auricolor Fraser, 1927, *Caconeura*.
autumnalis Fraser, 1922, *Caconeura*.
bilineata Fraser, 1922, *Melano-neura*.
botti Fraser, 1922, *Caconeura*.
burmanensis Fraser, 1933, *Caconeura*.
cacharensis Fraser, 1933, *Disparoneura*.
cæsia Laidlaw, 1924, *Disparoneura*.
cæsia Selys, 1860, *Alloneura*.
campioni Fraser, 1922, *Disparoneura*.
canningi Fraser, 1919, *Caconeura*.
cellularis Grünberg, 1902, *Disparoneura*.
centralis Selys, 1860, *Alloneura*.
chalybeostoma Lieftinck, 1932, *Notoneura*.
circumscripta Selys, 1886, *Alloneura*.
cælestina Tillyard, 1906, *Alloneura*.
cærulescens Fraser, 1932, *Caconeura*.
Chlorocnemis abbotti (Calvert, 1892).
Prodasineura vittata (Selys, 1886).
Elattonneura alba (Förster, 1906).
Elattonneura analis (Selys, 1860).
Prodasineura andamanensis (Fraser, 1924).
Prodasineura annandalei (Fraser, 1921).
Disparoneura apicalis (Fraser, 1924).
Prodasineura delia (Karsch, 1891).
Prodasineura delia (Karsch, 1891).
Notoneura astrolabica (Förster, 1898).
Elattonneura atkinsoni (Selys, 1886).
Elattonneura aurantiaca (Selys, 1886).
Prodasineura croconota (Ris, 1916).
Prodasineura autumnalis (Fraser, 1922).
Melano-neura bilineata Fraser, 1922.
Prodasineura botti (Fraser, 1922).
Prodasineura burmanensis (Fraser, 1933).
Elattonneura cacharensis (Fraser, 1933).
Elattonneura centralis (Selys, 1860).
Elattonneura cæsia (Selys, 1860).
Elattonneura campioni (Fraser, 1922).
Prodasineura sita (Kirby, 1894).
Isomecocyclus ? cellularis (Grünberg, 1902).
Elattonneura centralis (Selys, 1860).
Notoneura chalybeostoma Lieftinck, 1932.
Notoneura circumscripta (Selys, 1886).
Notoneura cælestina (Tillyard, 1906).
Prodasineura cærulescens (Fraser, 1932).

- collaris* Selys, 1860, *Alloneura*.
corvina Lieftinck, 1930, *Caconeura*.
croconota Ris, 1916, *Disparoneura*.
cruentata Lieftinck, 1932, *Notoneura*.
cyaneovittata Fraser, 1922, *Esme*.
cyanura Forster, 1909, *Chlorocnemis*.
cyanura Lieftinck, 1932, *Notoneura*.
delia Forster, 1907, *Disparoneura*.
delia Karsch, 1891, *Disparoneura*.
delicatula Lieftinck, 1930, *Caconeura*.
dohrni Krüger, 1898, *Alloneura*.
dolorosa Needham, 1930, *Indoneura*.
dorsalis Selys, 1860, *Alloneura*.
dorsonigra Martin, 1902, *Allo-
neura*.
eburnea Förster, 1897, *Caconeura*.
elongata Selys, 1863, *Chlorocnemis*.
erythroprocta Selys, 1886, *Allo-
neura*.
erythrura Lieftinck, 1932, *Notoneura*.
exul Selys, 1886, *Alloneura*.
finisterræ Forster, 1897, *Caconeura*.
flavipennis Selys, 1863, *Chlorocnemis*.
flavipennis Selys, 1886, *Alloneura*.
fletcheri Fraser, 1919, *Disparoneura*.
fonticola Lieftinck, 1932, *Notoneura*.
fraterna Lieftinck, 1933, *Notoneura*.
frenulata Selys, 1860, *Disparoneura*.
fruhstorferi Krüger, 1898, *Allo-
neura*.
geminata Fraser, 1926, *Caconeura*.
gestroi Martin, 1908, *Chlorocnemis*.
glauca Selys, 1860, *Disparoneura*.
gomphoides Laidlaw, 1917, *Indoneura*.
gomphoides Rambur, 1842, *Argia*.
Prodasineura collaris (Selys, 1860).
Prodasineura autumnalis (Fraser, 1922).
Prodasineura croconota (Ris, 1916).
Notoneura rosea (Ris, 1913).
Esme cyaneovittata Fraser, 1922.
Isomecocnemis cyanura (Forster, 1909).
Notoneura cyanura Lieftinck, 1932.
Prodasineura humeralis (Selys, 1860).
Prodasineura delia (Karsch, 1891)
Prodasineura delicatula (Lieftinck, 1930).
Prodasineura dohrni (Kruger, 1898).
Prodasineura autumnalis (Fraser, 1922).
Prodasineura dorsalis (Selys, 1860).
Notoneura dorsonigra (Martin, 1902).
Notoneura eburnea (Forster, 1897).
Chlorocnemis elongata Selys, 1863.
Notoneura erythroprocta (Selys, 1886).
Notoneura erythrura Lieftinck, 1932.
Notoneura exul (Selys, 1886).
Notoneura finisterræ (Forster, 1897).
Chlorocnemis flavipennis Selys, 1863.
Notoneura flavipennis (Selys, 1886).
Elatoneura atkinsoni (Selys, 1886).
Notoneura fonticola Lieftinck, 1932.
Notoneura fraterna Lieftinck, 1933.
Elatoneura frenulata (Selys, 1860).
Notoneura insignis (Selys, 1886).
Notoneura eburnea (Förster, 1897).
Chlorocnemis gestroi Martin, 1908.
Elatoneura glauca (Selys, 1860).
Caconeura ramburi (Fraser, 1922).
Caconeura gomphoides (Rambur, 1842).

- gracillima* Selys, 1886, *Alloneura*.
hosei Laidlaw, 1913, *Disparoneura*.
humeralis Selys, 1860, *Alloneura*.
hyperythra Selys, 1886, *Alloneura*.
inepta Grünberg, 1902, *Chlorocnemis*.
insignis Selys, 1886, *Alloneura*.
integra Selys, 1882, *Alloneura*.
interrupta Selys, 1860, *Alloneura*.
karnyi Laidlaw, 1926, *Caconeura*.
laidlawii Förster, 1907, *Disparoneura*.
lansbergei Selys, 1886, *Alloneura*.
leucostigma Fraser, 1933, *Disparoneura*.
longistyla Fraser, 1931, *Esme*.
mackwoodi Fraser, 1919, *Caconeura*.
marina Ris, 1913, *Caconeura*.
marshalli Ris, 1921, *Chlorocnemis*.
moluccensis Selys, 1886, *Alloneura*.
moultoni Laidlaw, 1912, *Disparoneura*.
mudiensis Fraser, 1931, *Esme*.
mutata Selys, 1886, *Disparoneura*.
nigerrima Laidlaw, 1917, *Disparoneura*.
nigra Förster, 1907, *Disparoneura*.
nigra Fraser, 1922, *Caconeura*.
nigrifrons Ris, 1913, *Caconeura*.
nigripes Selys, 1886, *Chlorocnemis*.
nigrofasciata Lieftinck, 1932, *Notoneura*.
notostigma Selys, 1860, *Alloneura*.
nubilipennis Karsch, 1893, *Chlorocnemis*.
obscura Fraser, 1933, *Indoneura*.
obsoleta Selys, 1882, *Alloneura*.
oculata Kirby, 1894, *Disparoneura*.
oculata Martin, 1907, *Disparoneura*.
o'doneli Fraser, 1923, *Caconeura*.
peramena Laidlaw, 1913, *Disparoneura*.
phaenissa Ris, 1929, *Caconeura*.
Prodasineura gracillima (Selys, 1886).
Prodasineura hosei (Laidlaw, 1913).
Prodasineura humeralis (Selys, 1860).
Prodasineura hyperythra (Selys, 1886).
Chlorocnemis inepta Grünberg, 1902.
Notoneura insignis (Selys, 1886).
Prodasineura integra (Selys, 1882).
Prodasineura interrupta (Selys, 1860).
Prodasineura delia (Karsch, 1891).
Prodasineura laidlawii (Förster, 1907).
Prodasineura lansbergei (Selys, 1886).
Elattonneura leucostigma (Fraser, 1933).
Esme longistyla Fraser, 1931.
Elattonneura centralis (Selys, 1860).
Notoneura marina (Ris, 1913).
Chlorocnemis marshalli Ris, 1921.
Notoneura moluccensis (Selys, 1886).
Prodasineura hyperythra (Selys, 1886).
Esme mudiensis Fraser, 1931.
? Elattonneura glauca (Selys, 1860).
Elattonneura nigerrima (Laidlaw, 1917).
Prodasineura humeralis (Selys, 1860).
Prodasineura nigra (Fraser, 1922).
Notoneura nigrifrons (Ris, 1913).
Chlorocnemis nigripes Selys, 1886.
Notoneura nigrofasciata Lieftinck, 1932.
Prodasineura notostigma (Selys, 1860).
Chlorocnemis nubilipennis Karsch, 1893.
Caconeura obscura (Fraser, 1933).
Prodasineura obsoleta (Selys, 1882).
Elattonneura centralis (Selys, 1860).
Chlorocnemis williamsoni (Martin, 1921).
Prodasineura o'doneli (Fraser, 1923).
Prodasineura peramena (Laidlaw, 1913).
Notoneura phaenissa (Ris, 1929).

- plagiata* Selys, 1886, *Alloneura*.
plagiozantha Lieftinck, 1932, *Notoneura*.
pruinosa Selys, 1886, *Disparoneura*.
pseudexul Ris, 1913, *Caconeura*.
quadrimaculata Rambur, 1842, *Argia*.
ramburi Fraser, 1922, *Indoneura*.
ramburi var. Fraser, 1922, *Indoneura*.
risi Fraser, 1931, *Indoneura*.
risi Schmidt, 1934, *Disparoneura*.
rosea Ris, 1913, *Caconeura*.
salomonis ♀ Förster, 1898, *Caconeura*.
salomonis a Ris, 1913, *Caconeura*.
salomonis b Ris, 1913, *Caconeura*.
salomonis c Ris, 1913, *Caconeura*.
salomonis Selys, 1886, *Alloneura*.
selysii Förster, 1896, *Caconeura*.
simba Martin, 1906, *Disparoneura*.
sita Kirby, 1894, *Disparoneura*.
solitaria Tillyard, 1913, *Alloneura*.
solitarius Tillyard, 1906, *Alloneura*.
souteri Fraser, 1924, *Disparoneura*.
subnodalis Selys, 1886, *Disparoneura*.
t-cerulea Fraser, 1933, *Indoneura*.
tenax Selys, 1860, *Alloneura*.
tetrica Laidlaw, 1917, *Disparoneura*.
theebawi Fraser, 1922, *Caconeura*.
torrenticola Förster, 1903, *Caconeura*.
verticalis Albarda, 1881, *Alloneura*.
verticalis Selys, 1860, *Alloneura*.
vittata Selys, 1886, *Disparoneura*.
wallacii Selys, 1886, *Alloneura*.
westermanni Selys, 1860, *Alloneura*.
williamsoni Martin, 1921, *Disparoneura*.
xanthomelæna Ris, 1919, *Caconeura*.
Notoneura plagiata (Selys, 1886).
Notoneura plagiozantha Lieftinck, 1932.
Elattonneura pruinosa (Selys, 1886).
Notoneura pseudexul (Ris, 1913).
Disparoneura quadrimaculata (Rambur, 1842).
Caconeura ramburi (Fraser, 1922).
Caconeura t-ceruleum (Fraser, 1933).
Caconeura risi (Fraser, 1931).
Prodasineura delia (Karsch, 1891).
Notoneura rosea (Ris, 1913).
? Notoneura nigrofasciata Lieftinck, 1932.
Notoneura nigrofasciata Lieftinck, 1932.
Notoneura nigrofasciata Lieftinck, 1932.
Notoneura salomonis (Selys, 1886).
Notoneura salomonis (Selys, 1886).
Notoneura selysii (Förster, 1896).
Elattonneura simba (Martin, 1906).
Prodasineura sita (Kirby, 1894).
Notoneura solitaria (Tillyard, 1906).
Notoneura solitaria (Tillyard, 1906).
Elattonneura souteri (Fraser, 1924).
Isomecocnemis subnodalis (Selys, 1886).
Caconeura t-ceruleum (Fraser, 1933).
Elattonneura tenax (Selys, 1860).
Elattonneura tetrica (Laidlaw, 1917).
Prodasineura theebawi (Fraser, 1922).
Notoneura astrolabica (Förster, 1898).
Prodasineura delia (Karsch, 1891).
Prodasineura verticalis (Selys, 1860).
Prodasineura vittata (Selys, 1886).
Notoneura wallacii (Selys, 1886).
Phylloneura westermanni (Selys, 1860).
Chlorocnemis williamsoni (Martin, 1921).
Notoneura xanthomelæna (Ris, 1919).

LIV.—*The First Genus and Species of Helotrephidæ (Hemiptera) from the New World.* By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History).

THANKS to the courtesy of Mr. Robert L. Usinger of the Bernice P. Bishop Museum of Honolulu, I have received for study a series of a remarkable new genus and species of Helotrephidæ, collected in Brazil by Mr. Fritz Plaumann.

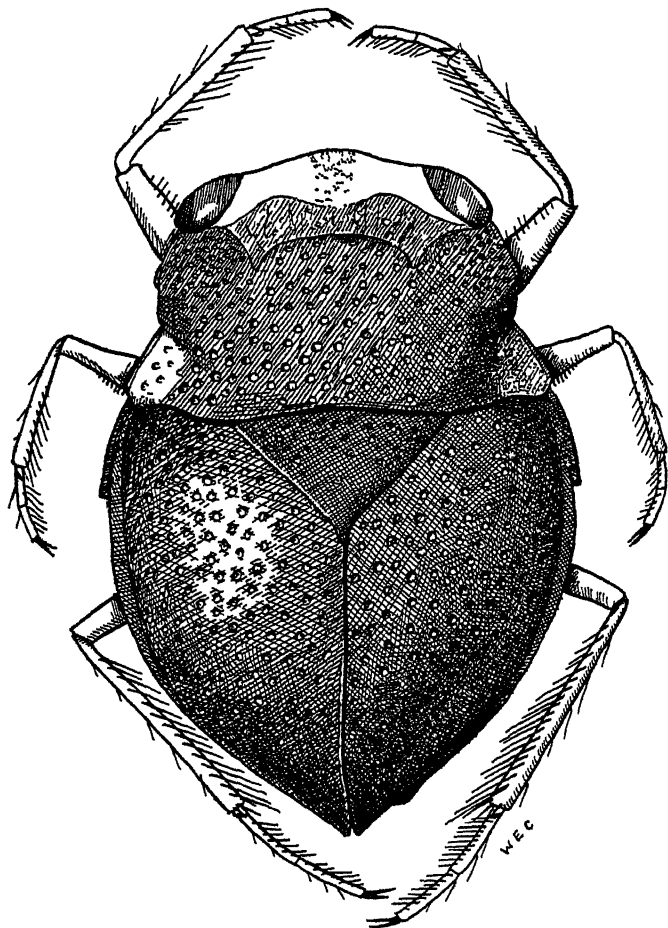
Now the family Helotrephidæ has hitherto been regarded as a purely Old World group, the subfamily Idiocorinæ being known only from the East African lake Tanganyika. It was therefore of great interest to find that the family was also represented in South America, and still more interesting to find that the New World form was in many ways intermediate in character between the subfamilies Helotrephinae and Idiocorinæ. Although Mr. Usinger recognized this fact, he very generously allowed me to describe this valuable material. I regret that distance makes it impracticable for my friend Prof. Teiso Esaki to cooperate with me in this work.

NEOTREPHES, gen. nov.

Body not so strongly convex above as in the Helotrephinae, but more so than in the Idiocorinæ; surface dull, not shining, pronotum and hemielytra strongly punctate; suture between head and pronotum present as in Helotrephinae, but the central sinuation much more shallow, scarcely reaching a line drawn between bases of eyes; cephalonotum relatively short, not strongly inflexed as in the Helotrephinids, its lateral margin strongly concavely sinuate in the pronotal region. Rostrum short, barely reaching apex of mesosternal keel; the third and fourth segments subequal, the fourth about twice as long as second (fig. 2 c). Antennæ very small, placed on ventral side of head near lateral margin on level with apex of eye; consisting of a single subglobular segment set in a shallow pit and protruding from it, upper side with very fine long bristles directed towards base of rostrum, and a curious circular organ near margin; subgenæ laminate, projecting anteriorly,

and visible from above (fig. 2 *b*). No distinct lateral plate (lateral pronotal plate and genal plate) as is found in the Helotrephinids; the ventral surface of head

Fig. 1.

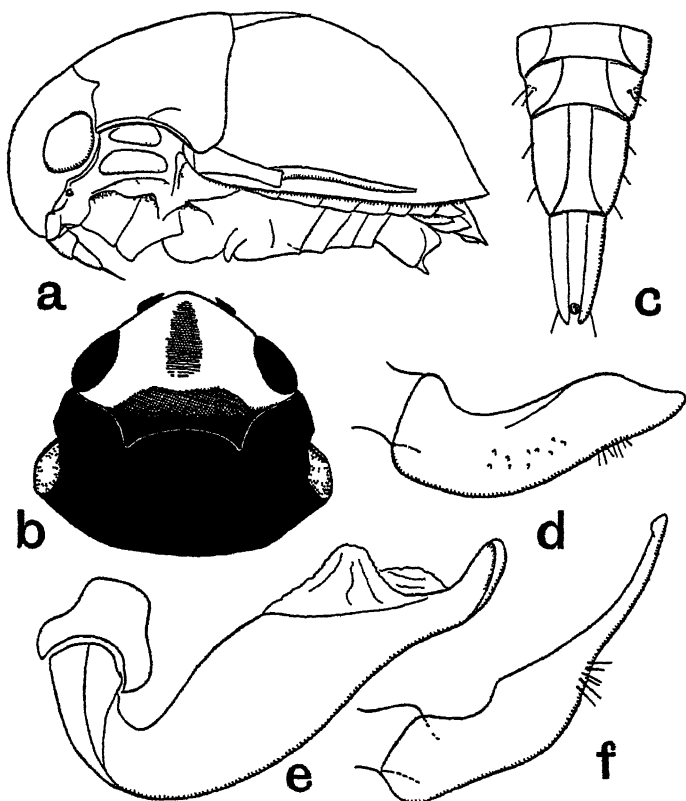


Neotrephes usingeri, gen. et sp. n. General appearance.

separated from dorsal surface by a distinct carina; the pleural area more or less fused, exhibiting two longitudinal ridges (fig. 2 *a*). Pro-, meso-, and metasterna represented by well-elevated laminate keels between the

coxæ, the mesosternal keel flattened ventrally. Pronotum strongly coarsely punctate, punctures finer behind eyes; lateral margins narrowly carinate. Scutellum much shorter than broad at base, its lateral margins straight.

Fig. 2.



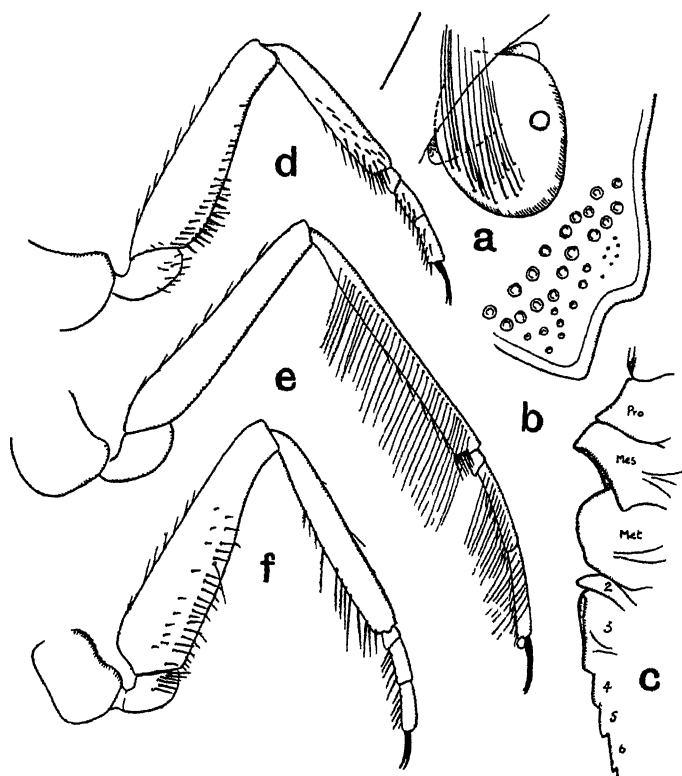
Neotrephes usingeri, gen. et sp. n.

a, lateral view of ♀ without legs to show position of antenna, structure of pleura, clavulus, lateral hemielytral ridge, and seventh ventrite; *b*, antero-dorsal view of cephalonotum to show colour pattern and suture; *c*, rostrum; *d*, dorsal paramere; *e*, aedeagus with basal plates; *f*, ventral paramere.

Hemielytra with the clavus and corium usually fused and wings vestigial, the clavulus feebly delimited but apically prominent in the form of a small tubercle; claval suture sometimes present, in which case wings are

fully developed and the clavulus distinctly delimited, but without the apical tubercle; right-hand hemielytron in female with a small but distinct lobe on costal margin near apex (fig. 3 *b*); a prominent impunctate ridge running along within the costal margin, extending from

Fig. 3.



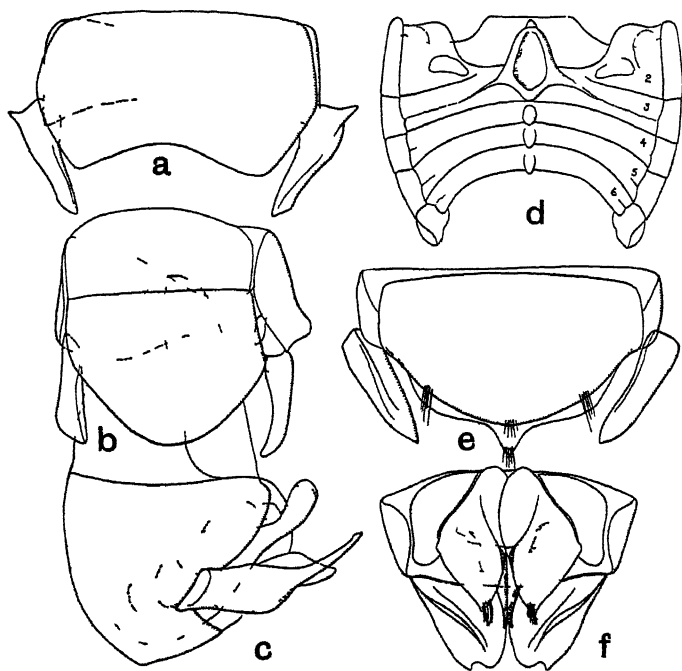
Neotrephes usingeri, gen. et sp. n.

a, antenna showing insertion, bristles, and sensory organ; *b*, apex of right-hand hemielytron of ♀ showing sensory lobe; *c*, lateral view of sternal and ventral carinae; *d*, middle leg; *e*, hind leg; *f*, front leg.

beneath apex of clavulus to about two-thirds length of hemielytron, and gradually narrowing and becoming evanescent (fig. 2 *a*). Legs very similar to those in *Idiocoris*, but all tarsi three-segmented, the basal segment very short, the second and third subequal, no comb-

headed bristles present (figs 3 *d*, *e*, & *f*). Second abdominal segment with a narrow subacuminate median process, third segment with a large lozenge-shaped median process strongly anteriorly produced, broadly flattened ventrally, its surface deeply concave (fig 4 *d*), fourth, fifth, and sixth segments with small obscure

Fig 4.



Neotrephes usingeri, gen et sp n

a, ventral view of seventh ♂ abdominal segment, *b*, ventral view of eighth ♂ abdominal segment, *c*, ventral view of ninth ♂ abdominal segment and genitalia. *d*, venter of ♀ showing carinae, *e*, ventral view of seventh ♀ abdominal segment, *f*, ventral view of eighth and ninth ♀ abdominal segments to show ovipositor (only principal bristles shown)

feebly elevated median tubercles; spiracles very small and difficult to distinguish. Male genital segments similar to those in the Helotrephinae (figs 4 *a*, *b*, & *c*), the pleural lobes of the seventh and eighth segments rather narrow, those of the seventh segment with prominent spurs at the base. Seventh female genital

segment similar to that in the Helotrephinae, but eighth and ninth segments quite distinct, without pleural lobes; a primitive form of ovipositor present (fig. 4 f).

Genotype: *Neotrephes usingeri*, sp. n.

Neotrephes usingeri, sp. n. (Fig. 1.)

Colour.—Head dull yellow, extreme base between sinuations of cephalonotum and eyes shining black, a median longitudinal stripe fuscous (fig. 2 b); subgenæ shining black; rostrum yellow with apical segment fuscous. Pronotum dull brownish black, the posterior lateral angles fulvous, the disk below central curve of cephalonotal suture and posteriorly in front of base of scutellum shading to ferruginous-brown. Scutellum ferruginous-brown shading to black on disk. Pleura dark brown, median sternal keels shining black. Coxæ dull brown, trochanters, femora, tibiae, and tarsi shining yellow shading to brown on tarsi; tarsal claws dark brown. Venter fulvous-brown, the median process of second and third segments and the genital segments shading to dark brown.

Structure.—Body oval, widest across apex of scutellum, practically glabrous except on genital segments. Head seen from front well produced in front of eyes, apically rounded; seen from above more or less truncate between eyes; surface rugosely punctate. Rostrum reaching apex of prosternum, relative length of segments 10:12:24:25. Antenna slightly longer than wide, antennal bristles restricted to anterior half, slightly longer than antenna. Cephalonotum seen from above about one and three-quarter times as wide across humeral angles as long in middle, the pronotum in middle to central arch of suture rather more than twice as long as head. Disk of pronotum very strongly, coarsely, and irregularly punctate, the punctures very much finer in region behind eyes and becoming evanescent behind central sinuation of suture. Humeral angles somewhat tumid. Pro-, meso-, and metasternal keels as figured (fig. 3 c), the mesosternal keel with its ventral edge broadened and strongly concave. Scutellum rather feebly punctate in basal angles, once and two-thirds broader at base than long in middle. Hemelytra strongly regularly punctate, the punctures deepest near basal lateral angles of corium

and becoming weaker towards apex. Legs figured (figs. 3 *d*, *e*, & *f*). Relative lengths :—

	Coxa.	Tro- chanter.	Femur.	Tibia.	T 1.	T 2.	T 3.	Claws.
Front leg..	20	15	55	48	4	8	10	9
Middle leg.	20	19	47	37	5	7	9	8
Hind leg..	20	20	63	61	4	18	20	9

(70=1 mm.)

Venter figured (fig. 4 *d*). Male genital segments figured (figs. 4 *a*, *b*, & *c*). Pygophor without a spur. *Æ*deagus with its apex spoon-shaped and concave towards dorsal side (fig. 2 *e*); ventral paramere broad at base, suddenly narrowed at half its length to a long finger-like process with a slightly barbed apex (fig. 2 *f*); dorsal paramere broad, obliquely truncate at apex (fig. 2 *d*). Seventh female ventrite with an apical median tooth-like process forming the apex of a plate-like prolongation (fig. 2 *a*) of the much thicker basal region of the ventrite, the posterior margin of which is broadly convexly rounded and is raised above (seen in ventral view) the thinner apical plate (fig. 4 *e*). The structure of the eighth and ninth female ventrites and of the sub-ovipositor is shown in fig. 4 *f*.

Total length, ♂ & ♀, 2.5 mm.

Greatest width (across hemielytra at apex of scutellum) 1.7 mm.

Larva (approximately last instar) :—

Head and eyes dull black except for large spot at each basal angle, and along interior margin of eyes, which are sordid yellow; mesonotum black, tending to fulvous along middle line; metanotum dull black, the posterior margin laterally and the middle of disk sordid yellow and fulvous respectively. Legs sordid yellow. Abdomen above dull black with sixth, seventh, and eighth segments broadly yellow at sides; ninth segment shining black; abdomen below shining black with connexivum dull yellow.

Whole of upper surface finely shagreened; antennal joint conical in shape; suture between head and pronotum distinct almost straight between posterior margins of eyes; pronotum with lateral margins widely foliaceous; lateral margins of mesonotum and abdomen also widely dilated; tarsi single-segmented, tapering towards apex.

Habitat.—Brazil, Province of Santa Catharina, Nova Teutonia.

4 ♂♂, 7 ♀♀, and 1 larva, 7 May, 1935 (*Fritz Plaumann*).

Specimens in collection of R. L. Usinger and British Museum (Nat. Hist.).

The species is dedicated to Mr. Robert L. Usinger, without whose perspicacity this remarkable new genus might have remained unknown for many years.

RELATIONSHIPS OF *NEOTREPHESES*.

The problem of the systematic position of the genus *Neotrephe*s must now be discussed. As already mentioned, and as pointed out by Mr. Usinger, this new genus is intermediate in character between the Helotrephinae and the Idiocorinae. The question is, do these characters warrant the erection of a new subfamily, or does *Neotrephe*s possess a preponderance of characters in one or other of the two groups? The best method of deciding this is by analysis of the principal characters.

1. Helotrephid characters :—

Globose shape; adult cephalonotal suture present, sinuate; larval cephalonotal suture straight, not sinuate.

2. Idiocorinid characters :—

One-segmented antennae; sinuate lateral margins of pronotum; absence of a distinct lateral pronotal plate.

3. Characters *sui generis* :—

Scutellum much shorter than broad at base; dorsal surface of head separated from ventral surface by a distinct keel, although propleuron not continuous with subgena; tarsal formula 3—3—3.

At first sight it would appear that *Neotrephe*s is almost as distinct from these two subfamilies as they are from one another. But are all these characters of equal value? Let us consider them in turn :—

1. Globose shape. This is only a general guide, since the degree of globosity in the Helotrephinae varies considerably, not only between such genera as *Limnotrephe*s and *Hydrotrephe*s, but between the various species of *Hydrotrephe*s. The globosity depends on the angle of inclination of the head and pronotum. The relationship of *Neotrephe*s with the Helotrephinae in this respect could probably be ignored.

2. Presence of a cephalonotal suture. This appears to be of more importance, but the complete fusion of the head and thorax in the Idiocorinids (*i. e.*, absence of suture) is an extreme specialization as shown by the fact that the larvæ have the suture present.

3. Segmentation of antenna. This seems to be of fundamental value. In only one family * of Hemiptera, so far as the writer is aware, is there a variation in the number of antennal segments. However, we must not overlook the fact that the larvæ of the two-segmented Helotrephinids, *Limnotrephes* and *Tiphotrephes*, both possess single-segmented antennæ, while the larvæ of the three-segmented Pleidæ also possess only single-segmented antennæ. Of course, a reduction in the number of antennal segments is normal in all Hemipterous larvæ, the reduction usually consisting of one segment †. The jump from single-segmented antennæ in the larva of *Plea* to three-segmented antennæ in the adult is very unusual. The larva of *Esakiella hancocki* Ch. possesses single-segmented antennæ, but the segment is not plate-like. It bears, however, the curious circular organ found in Idiocorinids.

4. Sinuate lateral margins of pronotum. While this character so far has proved to be constant in the separation of the Idiocorinæ from the Helotrephinæ, one can imagine this consistency to be purely fortuitous. There is no inherent reason why perfectly good Helotrephinids should not possess sinuate lateral margins of the pronotum.

5. Absence of a distinct lateral pronotal plate.

This character seems to be a very fundamental one, apparently not connected with the fusion of the head and pronotum. The plate is absent, however, in the larvæ of the Helotrephinids.

6. Scutellum. The very short broad scutellum in *Neotrephes*, although a good generic character, may not be of any subfamily importance.

* The Pentatomidæ, in which, if we exclude the genera *Phloa* L. & S. and *Serbana* Dist., which, properly speaking, form a distinct family Phloëidæ, there are only two genera with other than five segments. These are *Tetrarthria* Dall. and *Pitha* Walk., both with four segments.

† According to Myers (Trans. New Zealand Inst. lvi. p. 467, 1926), the nymph of the Peloriid *Xenophyes cascus* Bergr. possesses the same number of antennal segments as the adult. In this it agrees with the majority of Homoptera, to which suborder the family has since been referred.

7. The distinctly carinate lateral margin of head without the presence of a subgenal plate seems to indicate a transitional stage between that found in the Helotrephinae and the Idiocorinae.

8. The tarsal formula 3—3—3 is certainly very different from the 1—1—2 of all the other Helotrephid genera, and of course reminds us of the Pleidæ in which the larval formula is also 1—1—1.

Summarizing we have only five characters of fundamental importance. One of these, the cephalonotal suture, is Helotrephid; two, the single-segmented antennæ and the absence of pronotal plate, are Idiocorinid; one, the lateral carinæ on head, is intermediate, and one is a Pleid character.

As has been shown in the "Monograph of the Helotrephinae" ('Eos,' iv. p. 170, 1928), the evolution of the Helotrephidæ has been one of specialization from the Notonectid type. The reduction of the antennæ from four segments to one, the increasing amount of fusion of head and thorax from the very slight degree with a straight suture to complete fusion without a suture, the reduction of the number of tarsal joints from 3—3—3 to 1—1—2, all give proof of this. The various groups have, however, become specialized more rapidly in one direction than in another. Taking the antennæ the order is Notonectidæ (4), Pleidæ (3), Helotrephinae (2), Idiocorinae (1). Taking the degree of fusion of the head and thorax the order is Notonectidæ (slight), Pleidæ (partial), Helotrephinae (almost complete), and Idiocorinae (complete). Taking the tarsal segmentation the order is *Plea* (3—3—3), *Notonecta* (3—3—2), Helotrephidæ (1—1—2). It will be noticed that in the case of the fusion of the head and thorax the larvæ lag behind in the specialization, whereas in the reduction of the segmentation of the antennæ and tarsi the larvæ are in advance of the adults. Of course, there is the normal developmental increase in the number of antennal and tarsal segments in all Heteroptera, which partially accounts for this phenomenon, but it would appear that extreme reduction of the antennæ is a larval adaptation in the Pleidæ and Helotrephidæ, which has been retained by the adults of the Idiocorinae and *Neotrepbes*. If we can place *Neotrepbes* in this evolutionary sequence its correct systematic position will be revealed.

While *Neotrephes* undoubtedly belongs to the Helotrephidæ it has retained certain of the primitive characters of its Pleid-like ancestors, such as presence of an ovipositor (doubtfully functional) and three-segmented tarsi. Within the family Helotrephidæ, while becoming as specialized as the Idiocorinæ in the reduction of the antennæ, it has retained the presumably more primitive partial fusion of the head and thorax. *Neotrephes* is not, therefore, intermediate between the Helotrephinæ and the Idiocorinæ in the truest sense—it is rather another branch of the evolutionary tree.

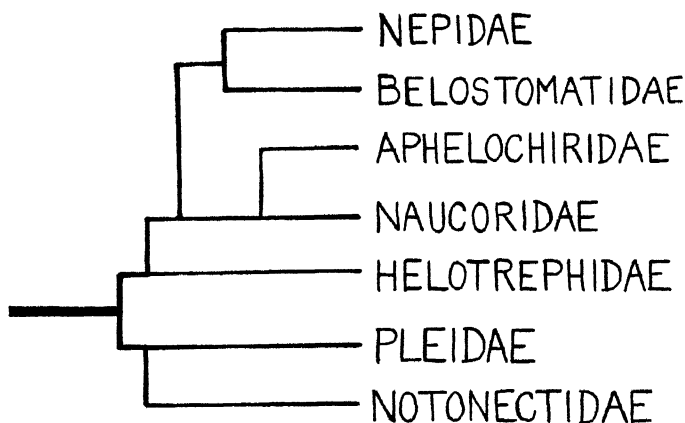
We are left with two alternatives, the suppression of the two existing subfamilies or the establishment of a third. Which we take depends on whether *Neotrephes* forms a subfamily branch or merely a generic twig. Now the S. American and African Helotrephidæ have been isolated since late Jurassic times, when, according to Wegener, these two continents began to separate. At that time the main characters of the Helotrephidæ must already have been established. It is reasonable to suppose therefore that *Neotrephes* must represent a distinct branch of the family and is not merely generically distinct. I propose, however, to refrain from erecting a new subfamily until more is known of the representation of this interesting family in S. America.

Mr. Usinger was struck by the resemblance of Helotrephid nymphs to the Naucoridæ. He writes:—"The most fundamental difference appears to be the absence of a labrum. The single unpaired median gland of the abdomen in the nymphs is closely approached in nymphs of *Heleocoris*. The tarsal formula is variable in the Laccocorinæ, the fusion of the head and pronotum in the Helotrephids is, as you have pointed out, a relatively recent modification to the environment as are the great development of the Naucorid legs and the great reduction of the Helotrephid antennæ. I don't know what relationships would show up between the genitalia of the two families, but asymmetry occurs in some of the Cryphocricinae."

When the family Helotrephidæ was first established (Trans. Ent. Soc. London, 1927, p. 295) the relationship with the Naucoridæ was discussed and discarded on the grounds of the absence of a labrum. In the "Monograph of the Helotrephinæ" ('Eos,' iv. p. 171, 1928) attention

was drawn to the fact that both the Naucoridæ and Helotrephidæ possessed only a single dorsal opening to the abdominal gland of the larva. The importance of this character, however, was shown to be lessened by the fact that in the Belostomatidæ and Nepidæ, both of which were supposed to be related to the Naucoridæ, the dorsal abdominal gland in the larva was absent. A hasty re-examination of the Naucoridæ has revealed the fact that this family resembles the Helotrephidæ in several respects. The hemielytron in some genera bears a distinctly delimited and abbreviated embolium, which suggests the clavulus of the Helotrephidæ. In the genera *Cryphocricos* and *Idiocarus*

Fig. 5.



Phylogeny of the Helotrephidæ and Naucoridæ.

there are distinct subgenal plates similar to those in the Helotrephidæ, and the labrum is reduced. As pointed out by Usinger, some *Cryphocricinae* possess asymmetrical genitalia, while in the *Limnocorinae* there are distinct ventral and sternal carinae, and in the *Laccocorinae* the tarsal formula is variable. There seems no doubt that there is a definite relationship between the two families, which is particularly interesting, since it shows how the *Nepoideæ* and the *Notonectoideæ* may have evolved from a common stock by way of the *Helotrephidæ* on the one hand and the *Pleidæ* on the other. This is shown in the accompanying family tree (fig. 5).

LV.—On a small Collection of Tridactylidæ and Gryllidæ from Anglo-Egyptian Sudan made by Mr. H. B. Johnston.
By L. CHOPARD.

Tridactylidæ.

Tridactylus digitatus Coq.

Khartum (H. W. Bedford, 10. viii. 1927), 1 ♀ at light.

Tridactylus madecassus Sauss.

Wad Medani, vi. 1928, 5 ♂♂, 5 ♀♀.

This is probably the insect which has been described by Karny as a variety *major* of *Tridactylus savignyi*.

Gryllidæ.

Gryllus bimaculatus De Geer.

Khartum (H. H. King, vii. 1927), 2 larvæ bred in laboratory.

Gryllus morio F.

Talodi (J. W. Cowland), 1 ♀ in house.

Gryllulus domesticus L.

Wad Medani, 1 larva in house.

Gryllulus configuratus Walk.

Wad Medani, 1 ♂ under tree.

This species was previously known from India only.

Gryllulus burdigalensis Latr.

Wad Medani, common; Bouga (W. E. Giffard), 1 ♀; Zeidab (W. E. Giffard), 1 ♀; Khor Arbaat (W. Rutledge, 24. iii. 1926), 1 ♂.

Gryllulus castaneus Chop.

Khartum, 24. ix. 1927, 1 ♀ at light.

Gryllulus alluaudi Chop.

Wad Medani, vi. 1928, 2 ♂♂, 5 ♀♀.

Gryllopsis apricus Sauss.

Khartum, 8. xii. 1926, 1 ♀.

Miogryllus nemobioides, sp. n.

Type: Wad Medani, vi. 1928, 1 ♀; Makwar (*W. Rutledge*, 16. x. 1926), 1 ♀ at light.

Very small, quite similar to a *Pteronemobius*; brown, with the edge of elytra yellowish. Head shining, without any ornament; palpi testaceous. Pronotum strongly transverse, with parallel margins; disk feebly convex, uniformly brown, with a faint pubescence; lateral lobes with a small yellowish spot in the anterior angle. Abdomen brown above, yellowish beneath. Ovipositor with small, lanceolate, acute apical valves. Legs rather short, yellowish brown; anterior tibiæ with very small or even obliterated internal tympanum; posterior femora very thick, darkened at apex; tibiæ armed with four spines on each margin; metatarsi long, bearing seven to eight external, three to four internal denticles, and a few erected spiniform bristles.

Elytra extending nearly to the apex of abdomen, a little narrowing towards the extremity, which is rounded; veins nearly longitudinal, five in number, rather regularly distant; transverse veinlets few and irregular; lateral field almost transparent, with four plain feebly curved veins. Wings lengthily caudate.

Length of body 6.5 mm.; length with wings 10.5 mm.; elytra 4.5 mm.; ovipositor 4 mm.

This very small species looks quite like a *Pteronemobius concolor* Walk., but with the characters of a true Gryllid. The example from Makwar shows a somewhat more irregular elytral venation.

Clearidas nigriceps Stål.

Koalib Hills (*H. H. King*, 8. xii. 1926), 1 ♀.

This species, which has been described from the Damara, seems rather widely distributed in tropical Africa.

Scapsipedus marginatus Afz. & Br.

Wad Medani, 1 ♀.

Pteronemobius gracilis Jak.

Nuir dist., Bahr el Ghazal (*B. H. Fergusson*, 3. iv. 1923), 1 ♀; Khor Arbaat Delta, 26. vi. 1926, 2 ♀, at light;

Wad Medani, vi. 1928, 1 ♀; Talodi (J. W. Cowland, 4. vi. 1926), 1 ♀.

Pteronemobius chopardi Bol.

Wad Medani, iii. 1928, 1 ♀ in house.

This species, very easy to recognize by its coloration, has been described from East Africa and has been found again at Madagascar; it has never been reported so far north as Wad Medani.

Anaxipha karschi Karny.

Bahr el Ghazal, Nuir distr., 1 ♂.

This species has been described from Gondokoro; it has already been reported from Anglo-Egyptian Sudan by Ebner (1935).

Myrmecophila ochracea Fieb.

Khartum (R. Cottam, 10. vi. 1926), 1 ♀, in company of *Camponotus maculatus*.

GRYLLOMIMUS, gen. nov.

Head with frontal rostrum wide and short; palpi slender. Pronotum very much widening backwards in male. Legs rather slender; anterior tibiæ perforated either side; posterior femora without filiform apical part; posterior tibiæ denticulated and armed with four spines on each margin; median apical spur the longest both on internal and external side. Cerci very long. Elytra of male very ample; speculum wide, with two dividing veins; five oblique veins. Elytra of female narrower, a little shorter than abdomen, with *Gyllus*-like venation. Wings caudate. Ovipositor rather slender, with lanceolate, smooth apical valves.

Genotype: *Gryllus chopardi* Ebner.

This genus belongs to the group Phalangopsinæ and can be placed close to the American genus *Lerneca*; it differs from it in the general shape of the male, in the long and slender maxillary palpi, the apical spurs of posterior tibiæ, the median one of which is longer than the superior one, and in the external aspect, which is very shining.

Gryllomimus chopardi Ebner.*Gryllus chopardi* Ebner, 1935, Anz. Ak. Wien, no. 15.*Gryllomimus pellucidus* Chopard, 1935, Bull. Soc. Sci. Nat. Maroc. xv. p. 40 (nom. nud.).

Talodi (*J. W. Cowland*, 10. x. 1926), 1 ♂; Makwar (*W. Rutledge*, 16. x. 1926), 1 ♀; Orlami, 1 ♂ at light.

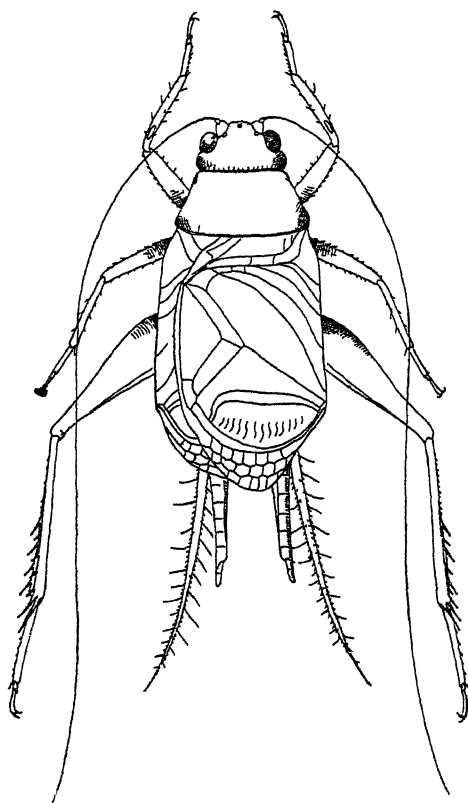
I give hereafter the description of the male of this interesting species, and add a few details to Ebner's description of the female.

♂.—Medium size, brownish, shining, with almost transparent elytra; legs yellow. Head short, shining, with frontal rostrum short and wide; face rufous, shining. Palpi long and slender, with three last joints subequal in length; fifth joint very weakly dilated at apex and obliquely truncated. Eye rather small, rounded, slightly projecting; ocelli small, disposed as a triangle. Antennæ yellow, very slender. Pronotum strongly transverse and very much widening backwards; anterior margin a little concave, ciliated; posterior margin very slightly convex, glabrous; disk nearly flat, rufous-brown, darkened in its posterior part; lateral lobes concolorous, low, with straight inferior margin, rounded angles. Abdomen brown above, yellowish beneath; subgenital plate wide, with truncated posterior margin. Cerci very long, rufous.

Legs yellow. Anterior and medium femora rather short and somewhat thickened; tibiæ slender, the anterior ones perforated with an oval tympanum either side; tarsi long, the metatarsus compressed, longer than the other two joints together; second joint very small, compressed. Posterior femora rather short and a little swollen; tibiæ slender, finely denticulated, and armed in their apical half with four spines on each margin; apical spurs yellow, rather long, chiefly the internal ones; the median spur is much the longer on each side, the supero-external one being a little removed towards the superior margin near the fourth spine. Metatarsi long, slender, cylindrical, very finely denticulated above.

Elytra wide, transparent except a small brown spot on the anal knot, and the apical field of the same colour; the enveloping vein of the mirror dark brown, speculum very wide, with right anterior angle, presenting in the middle two parallel dividing veins; diagonal vein very

short; first chord straight, second one much bowed, third subangular, sending a veinlet to the anterior angle of the mirror; five parallel undulated oblique veins; anal field short; apical field presenting three veins and a very regular reticulation; lateral field enveloping, the mediastinal vein bearing four branches. Wings extending little beyond the elytra, whitish.



Gryllomimus chopardi Ebner, ♂.

♀.—Head and legs as in male; pronotum not widening backwards. Ovipositor rather long, slender, with small, lanceolate, smooth apical valves. Elytra shining brown, a little shortened, narrow at apex; dorsal field presenting five veins which are slightly oblique, disposed as in the species of the genus *Gryllus*; between the second and

the third runs a false vein; transverse veinlets forming a reticulation in very long rectangles; lateral field brown, the mediastinal vein bearing five branches. Wings whitish, extending rather lengthily beyond the elytra on account of the shortness of the latter.

Length of body, ♂ 10 mm., ♀ 9 mm.; post fem., ♂ 6.5 mm., ♀ 6 mm.; elytra, ♂ 9 mm., ♀ 5.5 mm.; ovipositor 9 mm.

The male of this species is very peculiar, but the female looks rather like a *Gryllus* with short elytra and long wings; anyhow, the legs and ovipositor are of a Phalangopsine type. Although I have not seen Ebner's typical specimen, there is no doubt that this is the species he described as a *Gryllus* from Talodi; the long and yellowish legs, and chiefly the posterior tibiæ finely serrulated in their basal part, are quite characteristic of the present species.

According to Johnston's observations the song of the male is a penetrating Cicada-like trill.

Homœogryllus reticulatus F.

Wad Medani, 2 ♂♂; Talodi (J. W. Cowland), 1 ♂ at light.

Homœogryllus parvus, sp. n.

Delami (W. Rutledge, 11. xii. 1927), 1 ♀ at light.

Very small for the genus, brownish. Head a little lighter than the body, with four brown bands on the occiput; frontal rostrum very narrow; face yellowish. Palpi brown. Antennæ ringed with brown and yellow. Pronotum transverse, with anterior margin almost straight, posterior one feebly convex, both ciliated; disk presenting towards the posterior third a curved impress; anterior part light testaceous, with two dainty brown lines near the middle; posterior part brown, with two round, testaceous, smooth spots; lateral lobes testaceous, with brown superior part and inferior margin. Abdomen brown above, yellowish beneath; subgenital plate notched. Ovipositor rather long, nearly straight, with large, narrow, lanceolate and smooth apical valves.

Legs rather long, pubescent. Anterior and medium femora darkened at apex; tibiæ brownish, the anterior ones perforated with a small tympanum on each side;

tarsi long, chiefly the metatarsus, which is almost double the other two joints together. Posterior femora moderately long, rather strong, a little darkened before the apex; tibiæ greyish, serrulated and armed with two external, three internal spines; externo-apical spurs short, the two superior ones equal in length; medio-internal spur longer than the superior one; metatarsi very long, presenting a few small denticles, scarcely visible among the pubescence.

Elytra a little longer than the abdomen, brown with yellowish veins; these are oblique, rather regularly distant, four in number, the third furcate, the fourth, which is parallel to the edge, trifurcate; reticulation scarce and irregular; lateral field high, the mediastinal vein bearing three branches. Wings caudate.

Length of body 8 mm.; length with wings 15 mm.; post. fem. 7.5 mm.; ovipositor 6 mm.

Besides the type, the following specimens are represented in the collection:—

Wad Medani, 2. iii. 1928, 1 ♀ in house; 14. v. 1928, 1 ♀ at light; Dana, Koalib, 21. x. 1927, 1 ♀ at light.

This species is still smaller than *Homæogryllus japonicus* and with shorter ovipositor.

Phæophilacris spectrum Sauss.

Khor Arbaat Delta, 1 ♀.

This specimen is somewhat lighter in coloration than those of British East Africa, but quite similar to them in other respects.

Phæophilacris abyssinica Sauss.

Red Sea Coast (W. P. L. Cameron, iii. 1926), three larvæ.

Æcanthus comptulus Karsch.

Amade (H. H. King, 9. i. 1925), 1 ♂ on tobacco; Talodi (J. W. Cowland, 10. ix. 1926), 1 ♂ on cotton; Enderaba, 1 ♀ at light.

Æcanthus similis Chop.

Wad Medani, 1 ♂; Gayland, 1 ♂.

Æcanthus karschi Chop.

Wad Medani, 1 ♂, 1 ♀ on cotton; Talodi, 1 ♀.

These specimens are quite like the South African ones; the female is nearly as narrow as that of *macer*, but larger, with very short ovipositor (length of body 14 mm., elytra 12 mm., ovipositor 5.5 mm.).

Æcanthus pellucens Scop.

Khor Hanaieit, 10. iv. 1926, 1 ♀ at light.

Æcanthus burmeisteri Sauss.

Khor Arbaat Delta, v. 1926, 1 ♀; Gendettu (*W. E. Giffard*, Oct. 1925), 1 ♀ in cotton-field.

Euscyrtus bivittatus Guér.

Torit (*J. R. Vardley*), 1 ♀.

LVI.—*The Hypopial Stage of Aleurobius farinæ Koch* (Tyroglyphidæ). By S. G. JARY, B.A., Entomologist, S.E. Agric. Coll., Wye, Kent.

PRIOR to the breeding of *Aleurobius farinæ* from a hypopus by Newstead and Duvall (2), the hypopial stage of this Tyroglyphid mite does not seem to have been recognized. They found it in small numbers only, and described, but did not figure, it. They also summarize previous references to the possible discovery of this stage by Michael, Berlese, Canestrini, and Oudemans. Michael (1) stated that he had never found the hypopus of this species, but he described and figured a hypopus which he associated with the species *Tyroglyphus longior*. Both his description and figure agree very closely with the description given by Newstead and Duvall for the hypopus of *A. farinæ*, and these workers give some indication that they observed the close similarity between Michael's description and theirs. Later, Newstead and Morris (2) figured a hypopus which they stated to be that of *T. longior* and which again agrees very closely with the description previously given by Newstead and Duvall for *A. farinæ*. Newstead and

Morris say of the species *T. longior* and *T. siro*, "the hypopi of both species are commonly met with."

It seems very probable that some confusion has taken place over the identity of the hypopial stages of certain of these species. The hypopial stage of *T. siro* was not known to Michael, and, so far as the writer is aware, has not been described or figured. Newstead and Morris, though they mention it, do not describe it. *T. siro* at best seems to be a somewhat doubtful species and cannot satisfactorily be separated from *T. longior*, as Newstead and Morris themselves stated. With regard to *T. longior*, the identity of the hypopus does not seem to have been established by obtaining adults either by Michael or Newstead and Morris.

In the opinion of the writer, the hypopus figured and described by Michael, and again by Newstead and Morris, is the hypopus of *A. farinæ* and identical, therefore, with the hypopus which Newstead and Duvall obtained and showed to belong to this species.

The occurrence of the hypopi with which the writer has been able to work were obtained in March 1935, when examining débris from stable floors in an attempt to discover whether certain Tyroglyphid species injurious to cultivated mushrooms existed in the stable manure. Samples of material were taken from a riding stable at Heacham, Norfolk, and some of these consisted of dry dusty débris from the floor, collected around posts and beneath mangers. The samples contained no horse droppings, very little short disintegrated straw, and were mainly composed of fine organic dust, with some soil, horsehair, and particles of grain. The acarine fauna of the samples was extremely varied, both *T. longior* and *A. farinæ* being well represented, presumably associated with the farinaceous material. The samples were kept in the laboratory in glass jars, covered with cellophane and shaded. Periodically a little water was added to prevent drying out, but the material eventually became somewhat drier than when *in situ* on the stable floor. During June hundreds of hypopi were found in some jars, and the presence of an abnormally long hair on the fourth pair of legs was a marked feature of them. With a magnification of $\times 20$ this hair could readily be discerned. Examination showed them to agree very

closely with the hypopus described by Michael as that of *T. longior*, of which he says:—"I believe that this hypopus has not been previously recorded."

Numbers of the hypopi were isolated and placed singly in glass cells similar to those described by Newstead and Duvall. In the bottom of each cell was placed a layer of moist sterile manure powder made from horse droppings, and the cells were kept in shallow tins on a damp layer of peat moss. Typical results obtained in these cells are shown in the table on p. 552. It was apparent immediately nymphs emerged from the hypopi that the species was not *T. longior*, and when adults were obtained it was readily established that *A. farinæ* was the species concerned. Both males and females were obtained, and the characteristic anterior legs of the males placed the identity beyond doubt. Further search among the original material showed that the hypopi were very abundant for some weeks, and large numbers were mounted and prepared in various ways for examination. No variations, except small differences in size, could be found, and of the numbers of hypopi bred through not one which possessed the long hair on the posterior legs produced *T. longior*—indeed, that species has never been obtained by the writer from a hypopus. There seems little doubt that Michael figured and described the hypopus of *A. farinæ* under the impression that he had the hypopus of *T. longior*. The two species so frequently occur on the same food-material that it is difficult to obtain a pure stock of one of them except by taking great precautions. It must be assumed that Michael did not verify his identification by breeding adults from the hypopi or he could have had no doubt as to the species, and he does not say whether he bred them or not. Alternatively, if Michael's figure and description of the hypopus do really refer to the species *T. longior*, then, in the writer's opinion, it is quite indistinguishable from that of *A. farinæ*—a very improbable state of affairs. Only in the minutest details, and after examination of a large number of preparations, could any differences whatever be detected between the hypopi from which *A. farinæ* was bred and that described by Michael as belonging to *T. longior*. These details, moreover, are such as might very easily have been overlooked unless a large number of specimens were examined.

Description.

The description given by Newstead and Duvall leaves little to be desired, and it is very similar to that given by Michael in describing *T. longior*. There is a little discrepancy in length; Newstead and Duvall say 0.16 mm. and Michael 0.2 mm. A considerable variation in size does occur, and is at once apparent when a large number of individuals are examined. Moreover, the body of the hypopus is so convex and highly refractive that actual measurements are not very reliable. The method of mounting may also influence the length, for with a little pressure on the cover-slip the hypopus can be flattened and most of the body-contents expelled, as Michael observed. The great majority of hypopi measured in the present instance were of the order of 0.2 mm., and some large ones measured 0.225 mm.

There are a few features which may be noted. The two pairs of long curved hairs on the dorsum of the cephalothorax are not stout spines as shown in Michael's figure, but relatively much longer, finer, and they do not taper to a point, but are almost parallel-sided and terminate bluntly. They are not infrequently lost or displaced during mounting, and their points of insertion are not very apparent. The minute hair near the anterolateral corner of the abdomen and the similar one on the lateral margin just behind it must be carefully sought for, but the two pairs of rather longer hairs at the posterior end, and slightly displaced from the median line, are more apparent. There are also two other minute hairs placed singly on the lateral margin, not figured or mentioned by Michael. If, however, the third and fourth pairs of legs were in the actual position as shown in his figure, these hairs would be obscured by the longer ones on the tarsus of the legs, projecting over the lateral margin.

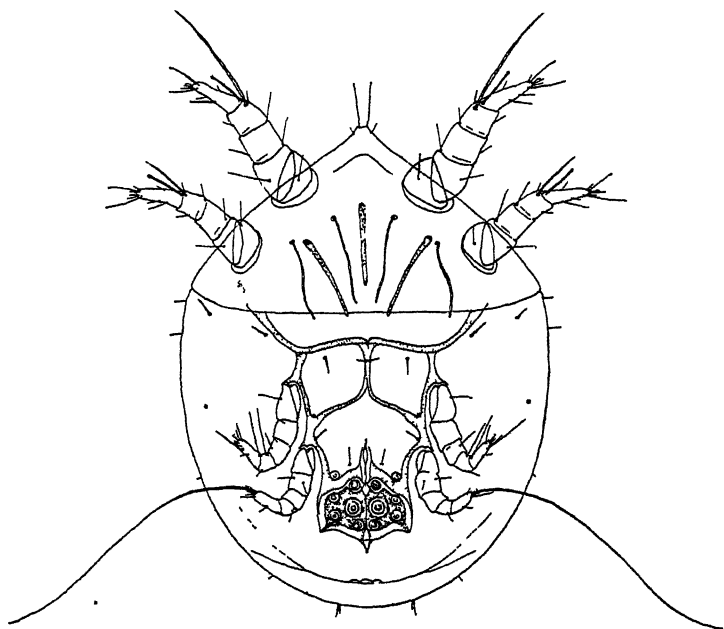
The sucker plate or disk is a more complicated structure than Michael figures, but, with very little simplification, it is apparent that the arrangement shown in the figure on p. 551 can easily be converted to his. The number and relative positions of the suckers is identical. The structure of the plate is so minute that a magnification of the order of $\times 500$ is necessary, and, with so highly chitinized and refractive a structure, it is not easy to

define the limits of the various areas: they will necessarily depend to a large extent upon the depth to which the focus is carried. The preparation must be well cleared in order to observe the detail, and this cannot be done except by compressing the cover-slip until the body-contents, minute oval granular bodies, are expelled. The fracture normally occurs near the junction of cephalothorax and abdomen, and does not injure any important structures.

The median and most heavily chitinized portion of the plate is a bilaterally symmetrical area, carrying a pair of very obvious large suckers, one on each side of the middle line. On the outer side of these suckers, and slightly in the rear of them, lies another pair of smaller suckers, each of which is connected by a faint conical structure to the posterior angles of a less highly chitinized area, which Michael clearly takes as the posterior limit of the actual plate. Immediately in front of these outer suckers lies another pair, one at each anterior corner of the plate. These are much less well defined, and their outer edges overlap into a comparatively clear band just forward of them. Immediately behind the large median pair of suckers lies another smaller pair, and, though the highly chitinized portion of the plate does not appear entirely to surround them, they are almost enclosed by it and may be regarded as belonging to the plate proper, which thus carries four pairs of suckers.

Immediately anterior to the plate itself, and in a median position, lies another pair of suckers, superimposed upon an area of little density, which appears as a narrow band around the anterior edge of the plate, but broadens out considerably in the region of these suckers. Still further forward, in line with the outermost suckers of the plate, is another pair of rather indistinct suckers. These are placed in the angle formed by the chitinized struts (epimera) connected with the articulation of the posterior pair of legs. On the inner side of these, and slightly anterior to them, is a pair of small hairs; lying between these hairs two pairs of bell-shaped objects can sometimes be observed, looking very much like the genital suckers found in the adults, which, indeed, they almost certainly are, and their presence was noted by Newstead and Duvall. They are not shown in the figure. Further forward, in the angles formed by the chitinized

struts associated with the articulation of the third pair of legs, occur two more minute translucent spots, suggestive of very tiny suckers. Possibly this appearance is due to reflexion from the curved surface of the chitin at this point, and, in any case, the objects are of little diagnostic importance since they are so faint. Opposite the coxæ of the third pair of legs, and lying just inside the lateral margin, the openings of the lateral vesicles may be seen.



S G Jary

Hypopus of *Aleurobius farinæ* Koch. Dorsal aspect, focussed halfway through body. Approx. $\times 255$.

Of the pairs of small hairs on the body of the hypopus, other than those already mentioned, Michael figures the almost contiguous pair on the median line just anterior to the coxæ of the third legs. He also shows a pair at the posterior end, just inside the margin and additional to the two pairs in this region already noted above. This third pair I have not found, nor are they mentioned by Newstead and Duvall. There are a

number of other small paired hairs (see figure, p. 551), all dorsal in situation and all rather difficult to see.

Certain characters of the legs are noteworthy. There is a progressive decrease in size from the first to the fourth pair. The somewhat clavate hair arising from the base of the tarsus on the two anterior pairs of legs is well marked, but sometimes lies over the tarsus itself, when it cannot be seen. A long tactile bristle, arising from the distal end of the tibia on the first pair of legs, is represented on the second pair by a similar but smaller bristle. The chaetotaxy of the third and fourth pairs of legs is similar, except for the very marked long hair on the tip of the tarsus of the fourth pair. Michael says of the hypopus of *T. longior* that the terminal hook on the tarsus is obsolete in the fourth pair of legs. It is quite apparent in some specimens of the hypopus in question, though frequently invisible owing to the fact that the long terminal hair obscures it. The very fine hair present on the coxæ of the first three pairs of legs, is absent from the fourth.

The carapace and most of the ventral surface of the body is minutely marked by shallow pits and is of a light brown colour.

*Records of breeding of Aleurobius farinæ from
Hypopi placed singly in glass cells.*

Hypopus introduced.	Adult emerged.
June 24	July 9. ♀.
July 9	July 20. ♂.
July 9	July 20. ♂.
July 9	July 23. ♂.
July 9	July 23. ♂.
July 9	July 26. ♂.
July 18	July 26. ♀.
August 1	August 7. ♂.
August 1	August 9. ♀.

The daily records of the development from individual hypopi are not included here.

REFERENCES.

- (1) 'British Tyroglyphidæ,' A. D. Michael, Ray Society, vol. i. 1901, vol. ii. 1903.
- (2) Reports of the Grain Pests (War) Committee, no. 2, 1918, Newstead and Duvall, and no. 8, 1920, R. Newstead and H. M. Morris.

LVII.—*House Mice* (*Mus musculus*) *in a Coal-mine in Ayrshire.* By CHARLES ELTON (Bureau of Animal Population, Department of Zoology and Comparative Anatomy, Oxford University).

THROUGH the help of Messrs. Bairds and Dalmellington, Limited, I received during November and December, 1935, twelve specimens of house mice which were living at the great depth of 1800 feet in Barony Colliery, Auchencleck, Ayrshire. They are believed to have got into this mine when a neighbouring one became connected with it at a higher level. The mice are thought to live on the feed of pit ponies and on crusts thrown away by the miners. Ponies are, however, not used so much now as they were. It is not impossible that there is an invertebrate fauna which the mice can also feed upon. There is one previous published record (Ritchie, 1914) of house mice living in a Scottish coal mine: at Niddrie in Midlothian, where they were found at a depth of 750 feet, in company with brown rats (*Rattus norvegicus*). There were also many slugs (*Limax maximus*), apparently living on fungi, and several species of insects, spiders, and worms.

However, life is probably not very luxuriant, since even the absence of enemies must tend to encourage increase of the population up to the limits of subsistence. The three specimens dissected had hardly any fat on them, although they were otherwise in good condition, and one male had active sperms. These mice had been caught in the stables. The temperature at that part of the mine is 57° F. with a variation of $\pm 4^{\circ}$ F. The average hygrometer readings for several days during the middle of November were: dry bulb, 57° C., and wet bulb, 55° F. The stables are electrically lit for about 10 out of the 24 hours. "The mice are more or less unseen when the lights are burning, but if the latter are extinguished for five minutes or so and then switched on, mice are seen scampering in all directions. . . . They are to be found also out in the coal workings, where the only supply of light is from the miners' hand-cap lamps."

Skins and skulls of three adults were prepared, and some details of the others recorded. Four out of eight mice weighing over 10 grams, and probably all adults,

showed a very interesting colour variation, with a light belly in place of the normal dark greyish one. In one skin preserved the centre of the belly is greyish buff with a tinge of yellow, while the flank line right from the mouth to the hind legs, and also a spot in front of the anus, have most of the hairs tipped with sandy yellow. My impression is that these colours were much more of a sulphur-yellow tinge in the living animals.

The colour of the back and sides in the variety is definitely browner and lighter than in the "normal" forms, while the latter are markedly dark coloured both above and below, compared with many specimens from the South of England or the Outer Hebrides. Furthermore, the skins of two "normal" mice from the mine were black inside, while that of the yellowish specimen dissected was whitish. The hind feet of the latter also are pale at the ends. There is thus evidence of a general shortage of dark pigment all over the skin and hair of the variety.

The dimensions are similar to those of ordinary house mice :—

Variety.....	Dk.	Dk.	Dk.	Dk.	Dk.	Y.	Y.	Y.	Y.	?	?	?
Sex	♀	♀	♀	♂	♂	♀	♂	♂	♂	♂	?	?
Wt. (gm.)	18	18	13	17	10	16	17	15	13	8	5	6
Body length (mm.)	90	..	..	..	71	..	93	..	86	..	64	67
Tail length from anus (mm.)	91	..	..	..	68	..	87	..	86	..	63	65
Hind foot to base of claws (mm.) .	17	..	..	..	17	..	16	..	17	..	16	16
State when examined	R	A	A	A	R	A	D	A	R	A	D	D

Dk=Dark. Y=Yellow. R=Recently killed. D=Dead some hours.
A=Alive. The yellow male weighing 13 gm. had active sperms.

The weights are about the same as those of house mice from Surrey, recorded by Barrett-Hamilton and Hinton (1921). They are less than those of house mice living near Stornoway in the Outer Hebrides. I have found the latter to be often between 20 and 30 gm., whereas the mainland forms seem mostly to be less than 20 gm. Outer Hebridean house mice, although otherwise resembling the mainland forms in colour and in the skulls,

approach in size the St. Kilda house mice (*Mus muralis*), for which Harrisson and Moy-Thomas (1933) give live weights ranging from 18–32 gm. The St. Kilda species forms, however, a very marked colour variety with a yellow belly, and also differs in the shape of the pterygoid bones of the skull. Hinton and Bathurst Hony (1916) found that the skulls of mice from the Butt of Lewis approached those of the St. Kilda mice in size, but did not have this difference in the pterygoids. It can be realised from this that size and colour variation in the different races of house mice are not correlated in any close way. This conclusion is confirmed by the Auchenleck specimens, which we have seen to be the same size as normal mainland mice, but to have dimorphism in the belly coloration. In colour they resemble most closely the variety taken by Waterston at Lochmaddy, on North Uist, Outer Hebrides, where it was living in company with the ordinary form (Eagle Clarke, 1905). The Lochmaddy mice were, however, large ones like those on Lewis and St. Kilda.

It may be noted that the St. Kilda house mice, usually referred to as a purely yellow-bellied variety, were probably dimorphic or variable at one time. Waterston, a reliable observer who carried out a very thorough study on the island in 1905, recorded (1905) that "it varies greatly in size and coloration of the belly, which is sometimes smoky and again a lovely creamy yellow." But Eagle Clarke, who collected a large number there in 1910 and 1911, definitely stated (1914) that he "did not obtain any specimens in which the under surface was smoky." Mr. Moy-Thomas, who worked there in 1931, informs me that the eleven mice trapped that summer (most of which were released) were all the yellow-bellied variety. It seems that most or all of the museum skins are yellow-bellied. In general, pale-bellied house mice of various species are found over the Mediterranean region, in Arabia, and Asia, often, though by no means always, living in desert or semi-desert regions, wild, semi-wild, or in houses. Oldfield Thomas (1896) found a pale-bellied form living in the woods and gardens of Portugal, where the normal form occurred in the houses. These wild Portuguese mice had shorter tails than the house form in the same area. but were

not abnormally large. Other colour forms have also been described in the British Isles. Jameson (1898) found a very mixed population living quite wild in the sand dunes of North Bull, an island in Dublin Bay, Ireland. These ranged from normal mice through a series of shades to very pale brown with pale buff bellies. Evans (1892) obtained some pale buff or cream-coloured house mice from a farm three miles west of Peebles, which is some 40 miles from Auchenleck. These, apparently, were light all over, and not just on the belly. Smalley (1932) found that house mice in the north of England are all dark coloured, while those in Suffolk are sandy brown. I have not yet examined his valuable collection, which is in the Royal Scottish Museum at Edinburgh: it may contain other forms. Finally, we may mention the very large species (*Mus faroensis*) which lives wild on some of the Faroe Islands (Eagle Clarke, 1904). Even here, there are probably other forms, since Annandale (1905) was told that the house mice in Thorshavn are a smaller race. The wild Faroe mice have light but not very light bellies.

We can conclude from all these facts that the house mouse varies greatly both in colour and size, and that these are not closely correlated. Where only one form occurs it is easy to create a species, as with the St. Kilda mice. Elsewhere dimorphism or complete gradation, or varieties living in slightly different habitats, may make such simple definitions difficult or impossible. Wood (1910), working in Illinois, U.S.A., found house mice very abundant in the fields in summer and autumn, and he noted very great variations in colour "from smoke-grey and drab-buff to near orange-buff," and that these might all occur in the same place. He adds, "I have not been able to correlate these variations with any ecological factor." Although Jameson suggested that natural selection acting through predatory birds was responsible for the colours of the North Bull population, this cannot be evoked to explain the colours of mice 1800 feet down a coal-mine; while the mice of Lewis, which live out of doors entirely in the summer, have shown no change in this direction.

There is always a possibility that colour variations might arise from crossing with coloured strains of tame

mice. There is no evidence on this question for Auchenleck, except that the mine authorities state that mice have not at any time been used for gas tests in the mine itself.

The habits and exceptional dispersal powers of house mice are constantly leading to the establishment of a few individuals, perhaps only one pair, followed by rapid expansion in numbers to form comparatively large populations. During such expansion unusual opportunities are presented for the spread of mutations which might otherwise remain rare (Hagedoorn, 1921; Elton, 1924). Such opportunities keep occurring not only when the species is carried round to an island or down a coal-mine, but also when it gets to a house or farm. Great abundance sometimes results in partial or complete extermination by man, leaving room for recolonization and more expansion. This situation is a rather different one from that considered theoretically by Haldane (1932), which led him to reject my suggestion as applied to species which fluctuate periodically without becoming actually exterminated.

It is satisfactory to record that six live house mice from Auchenleck have been handed over to Dr. O. Philip for genetical breeding studies in Professor J. B. S. Haldane's laboratory at University College, London. It is from such studies, correlated with ecological field-work, that real light will be thrown on the nature and origin of wild varieties and species. The variations of the house mouse clearly show that systematic descriptions should be considered as only a convenient halfway house on the way towards such coordinated field and experimental studies.

ACKNOWLEDGMENTS.

This study was made possible by the great help and courtesy received from officials of Messrs. Bairds and Dalmellington, in particular from Mr. David L. McCardel and Mr. Gavin Hamilton. I wish also to thank Mr. J. Maxwell MacDonald and Mr. William Logan for useful information, and Dr. Philip for supplying me with weights and descriptions of the six mice kept alive.

REFERENCES.

- ANNANDALE, N. 1905. 'The Faeroes and Iceland,' p. 50. Oxford.
 BARRETT-HAMILTON, G. E. H., & HINTON, M. A. C. 1910-21.
 'A History of British Mammals,' p. 650.
 EAGLE CLARKE, W. 1904. Proc. R. Phys. Soc. Edinburgh, xv. p. 160.
 ——. 1905. Ann. Scot. Nat. Hist. p. 198.
 ——. 1914. Scot. Nat. p. 124.
 ELTON, C. S. 1924. Brit. J. Exp. Biol. ii. p. 119.
 EVANS, W. 1892. 'The Mammalian Fauna of the Edinburgh District,'
 p. 76. Edinburgh.
 HAGEDOORN, A. L. & A. C. 1921. 'The Relative Value of the
 Processes causing Evolution.' The Hague.
 HALDANE, J. B. S. 1932. 'The Causes of Evolution,' p. 204. London.
 HARRISSON, T. H., & MOY-THOMAS, J. A. 1933. J. Anim. Ecol.
 ii. p. 109.
 HINTON, M. A. C., & BATHURST HONY, G. 1916. Scot. Nat. p. 221.
 JAMESON, H. L. 1898. J. Linn. Soc. London, Zool. xxvi. p. 465.
 RITCHIE, J. 1914. Scot. Nat. p. 15.
 SMALLEY, F. W. 1932. Scot. Nat. p. 125.
 THOMAS, OLDFIELD. 1896. 'Zoologist,' xx. p. 137.
 WATERSTON, J. 1905. Ann. Scot. Nat. Hist. p. 199.
 WOOD, F. E. 1910. Bull. Illinois Lab. Nat. Hist. viii. p. 539.

LVIII.—*New Parasitic Hymenoptera from Africa (Proctotrupoidea, Subfam. Telenominæ)*. By G. E. J. NIXON, B.A., Department of Entomology, British Museum (Natural History).

MICROPHANURUS Kieffer.

Microphanurus lemoleæ, sp. n.

In my revision of the African Telenominæ*, I unfortunately recorded this species as *Telenomus thestor* Nixon.

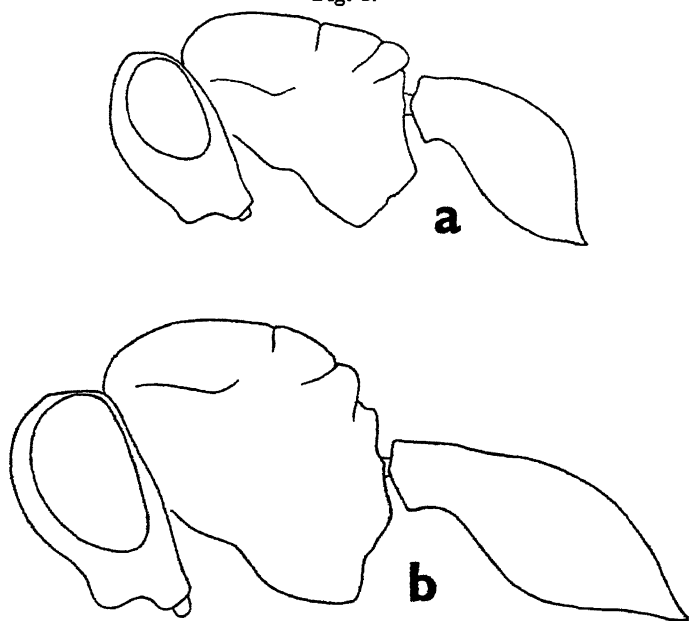
In the small series of 3 ♀♀ and 3 ♂♂, from which I now describe it, I can see no trace of hairs on the eyes and therefore place it in *Microphanurus*, although in size and sculpture it much resembles *Telenomus*. The insect is minute, about half a millimetre in length, much smaller than any African species of *Microphanurus* with which I am acquainted, and, on the strength of its size alone, is very characteristic, if the absence of hairs on the eyes is truly a constant feature.

♂♀.—Black. Legs dirty brownish yellow with the tarsi and articulations paler. Antennæ of the ♀ are much the same colour as the darker parts of the legs.

* Trans. Roy. Ent. Soc. 1935, p. 79.

♀.—*Head* strongly transverse, clearly wider than the thorax, and, seen along a line perpendicular to a line between the posterior ocelli, slightly more than twice and a half as wide as its greatest length. Frons almost everywhere entirely smooth and shining; surface immediately in front, and to the sides of, the anterior ocellus, moderately shining, with vague scratches and rugulosities and distinct, but not at all sharply defined, scattered punctures. Vertex rather sharply angled between the posterior ocelli. Between the posterior ocelli

Fig. 1.



a, *Microphanurus lemozei*, sp. n.; b, *Telenomus demodoci*, sp. n.

there is some indication of a fine raised line separating the anterior part of the vertex from the posterior (declivous) part. Eyes completely bare and, seen from above, occupying the entire lateral surface of the head. Antennæ: radicle hardly one-fourth the length of the scape; pedicel thicker than funicle 1 and a little shorter than funicles 1 and 2 together; funicle 1 very slightly longer than wide; 5 not strongly transverse; club not sharply differentiated, feebly 5-segmented.

Thorax somewhat flattened above (fig. 1 a, p. 559). Mesonotum feebly shining, its sculpture very weak and quite indefinite; there is a tendency towards fine scaly reticulation on anterior part, and posteriorly, where the sculpture becomes more vague, there are indications of minute ill-defined punctures; pubescence of this sclerite so indistinct as to be virtually absent (magnification $\times 60$). Scutellum flattened and completely smooth over its greater medial part. Postscutellar swelling slightly overlapping the propodeum. The entire thorax lies more or less in the same plane as the abdomen, an unusual feature in *Microphanurus*. Fore wings greyish, the venation likewise greyish and not very sharply defined; hind wing very narrow, the fringe fully three-fourths as long as the greatest width of the wing.

Abdomen but little longer than its greatest width, small in comparison with the size of the thorax; tergite 2 striate only at extreme base.

♂.—Antennæ brownish, the more apical segments of the funicle more or less spherical; otherwise like the ♀. Genitalia (fig. 2 a).

Length, ♂♀, .55 mm. approx.

UGANDA: Bukalasa (*H. Hargreaves*): series of 3 ♀♀, 3 ♂♂, bred ii. 1932 from eggs of a *Lycænid* butterfly, ? *Spalgis lemolea* H. H. Druce, on coffee berries.

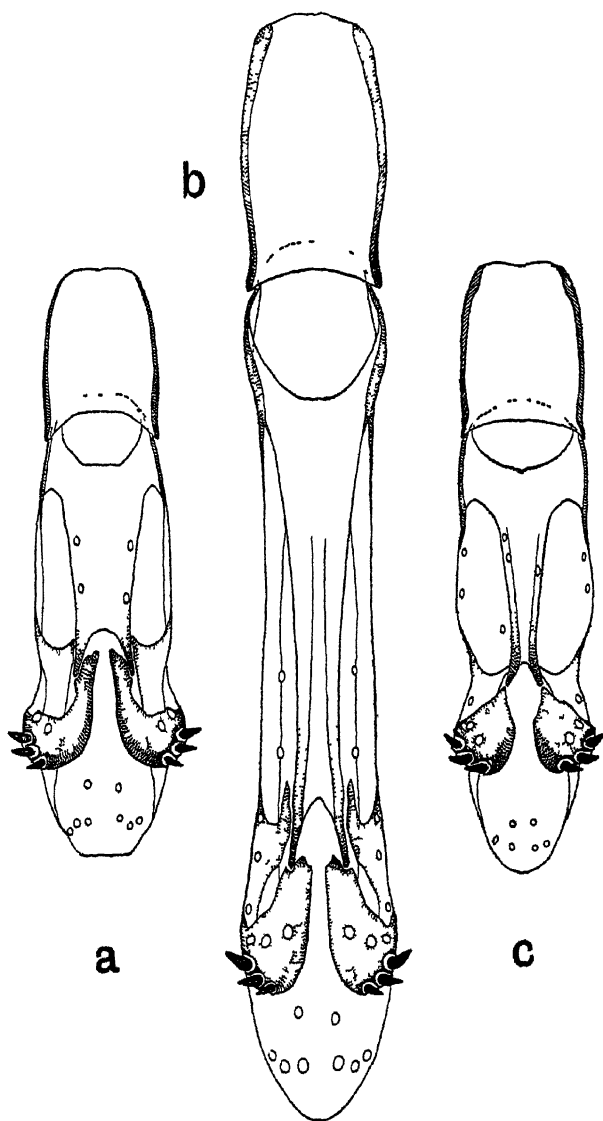
This species is largely characterized by a subtle distinctiveness in facies, produced probably by the condition of thorax and abdomen lying more or less in the same plane. It is not to be confused with any African species of *Microphanurus* known to me. Its sculpture, colour of wings and of venation, and shape of hind wing are strongly reminiscent of *Telenomus*, from which I separate it on account of absence of hairs on eyes. Absence or presence of hairs on the eyes constitutes the only character which I regard as valid for separating the numerous species of the *Microphanurus-Telenomus* complex.

TELENOMUS Haliday.

In my key to African *Telenomus**, the two following species run to *thestor* Nixon and *procas* Nixon, two forms the females of which I coupled together in the table

* Trans. Roy. Ent. Soc. 1935, p. 75.

Fig. 2.



Male genitalia of: a, *Microphanurus lemoleæ*, sp. n., b, *Telenomus demodoci*, sp. n., c, *Telenomus ullyetta*, sp. n.

for lack of any good characters to separate them. The males of *thestor* and *procas* have very different genitalia from each other, and also from those of the two species which I am introducing here as new. The problem is thus: we have a complex of at least four species, the females of which are almost impossible to separate by means of the criteria hitherto used for separating the species of the genus, while the males can be distinguished easily by the form of the genitalia. All four species have been bred from eggs of known species of Lepidoptera. Except in the case of *procas*, where two series were bred from the same host, *Deiopeia pulchella*, only one series of each species of parasite is available, so that it is impossible to say yet how far the host of each is specific.

The four species of *Telenomus* discussed above have the following characters in common:—

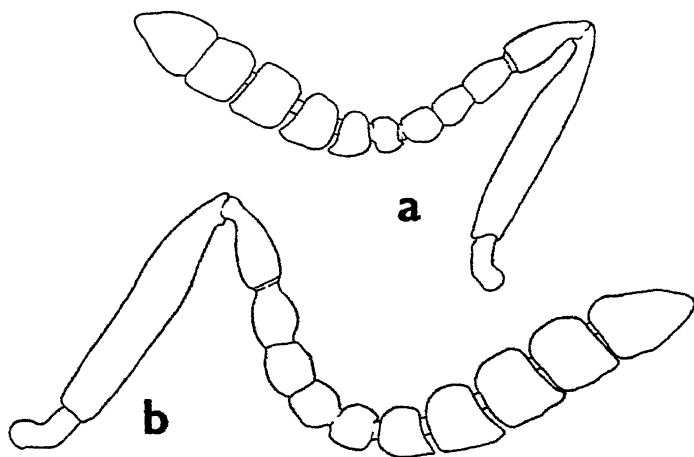
Small species, at most .8 mm. in length. *Colour*: black; antennæ blackish throughout; legs obscure yellowish brown. *Head* seen along a line perpendicular to a line between the posterior ocelli more than twice as wide as its greatest length, markedly wider than the thorax. Vertex rather sharply angled between the posterior ocelli. Eyes occupying the entire lateral surface of the head. When the head is seen from above, its sides between the postorbital margin and the occipital margin quite straight and almost parallel to the transverse axis of the head. Frons everywhere, right across to the inner margin of the eye, entirely smooth and shining. *Antennæ*: radicle not more than one-fourth the length of the scape; funicle 2 but little longer than wide; club of funicle not clearly differentiated. *Thorax* evenly convex, raised high above the level of the abdomen; mesonotum feebly shining and with only a very fine, vague, indeterminate sculpture; sometimes it is possible to make out excessively minute, but never sharp punctures, interconnected by a fine scratched surface-sculpture; anteriorly the mesonotum tends to show minute granulations. *Wings* slightly smoky grey, the venation likewise greyish and, comparatively, not sharply defined; hind wing narrow, its fringe two-thirds as long as greatest width of wing in *demodoci*, sp. n., fully as long in the others. *Abdomen* not,

or hardly, longer than thorax and not more than about once and a half as long as its greatest width; striations of tergite 2 reduced, more or less, to a costate furrow at extreme base of the segment.

Telenomus ullyetti, sp. n.

♂♀.—This species differs very slightly in venation from *thestor* Nixon in that the stigmalis at apex is better defined. From *procas* Nixon it differs in having the hind wings very slightly narrower, more or less parallel-sided. Antennæ (fig. 3 a).

Fig. 3.



Female antenna of : a, *Telenomus ullyetti*, sp. n. ;
b, *Telenomus demodoci*, sp. n.

♂.—Funicle dark brown, segments 7–11 more or less spherical. Genitalia (fig. 2 c) roughly similar to those of *thestor* with regard to the relation of length to breadth, but very different in detail, as a comparison of the figures will at once show.

Length, ♂♀, .5–.6 mm. Size equal to that of *procas* and *thestor*.

S. AFRICA : E. Transvaal, Tonetti (G. C. Ulyett) : series of 2 ♀♀, 10 ♂♂, bred Sept. 1930, and 3 ♀♀, 6 ♂♂, bred Dec. 1930, from eggs of *Heliothis obsoleta* Fab., on beans.

Telenomus demodoci, sp. n.

♂♀.—A slightly larger insect than the three species discussed above, about .8 mm. (fig. 1 b).

Head: vertex not so sharply angled between the posterior ocelli as in *ullyetti*. *Antennæ* (fig. 3 b). *Thorax*: mesonotum slightly less shining, and its sculpture more definite, than in *ullyetti*. Hind wing by no means parallel-sided, its fringe only about two-thirds to three-fourths the greatest width of the wing.

♂.—*Antennæ* yellowish brown; segments 7–11 of the funicle slightly transverse. *Genitalia* (fig. 2 b) very distinctive, longer and narrower than in *ullyetti* and *thetor*, besides differing in details.

UGANDA: Kampala (*H. Hargreaves*): 5 ♀♀, 2 ♂♂, bred from eggs of *Papilio demodocus* on various dates in October and November 1929.

LIX.—On *Psollicucumis Heding* and its Allies.

By HUBERT LYMAN CLARK and ELIZABETH DEICHMANN.

THE discovery of a new genus and species of dendrochirote holothurian from off Timor, viz., *Psollicucumis apneumona* Heding, reported in this journal (1), was of so great interest that the Museum of Comparative Zoölogy sought an exchange with the British Museum, where the types belong, and also secured, from the Zoological Museum in Amsterdam, the loan of Sluiter's material, used in describing *Cucumaria nocturna* (now referred to *Staurocucumis* Ekman 1927 (2), to which Heding's new species seemed closely allied. Indeed, the study of the excellent description and exquisite figures immediately leads one to question whether this supposedly new form represents anything but large individuals of Sluiter's species in which the respiratory trees have been lost. The lack of distinct anal papillæ and the feeble development of the cloaca, as indicated by Heding's figures, made this hypothesis seem reasonable.

Direct comparison of Sluiter's and Heding's material, side by side, shows that the two forms are identical. It was an error to describe *S. nocturna* as having two smaller ventral tentacles; they are all equally large, but in some cases two were partly hidden in the mouth,

so they gave the impression of being smaller. Sluiter's material (5 specimens) ranges from 8–22 mm. in length (a sixth specimen from much shallower water, 204 metres, and hard coral sand measures 26 mm., has much heavier spicules and a larger number of dorsal appendages; it may possibly represent an ecological variety. Sluiter's record of 32 mm. length may possibly refer to a seventh specimen, not sent to us). The specimens of *Psollicucumis* from the British Museum measure 32 mm. in length and represent a stage probably less than a year older; the gonads are slightly larger than in Sluiter's material.

Externally all the specimens agree well: the numerous ventral feet, the few papilliform dorsal appendages, all restricted to the radii, and, in the case of mature specimens, the pear-shaped form of the body, caused by the size of the gonads. The spicules also are identical to a notable degree (except in the specimen of *nocturna* from shallow water, already mentioned, where they are somewhat heavier and apparently exclusively short-armed; see Sluiter's figure, pl. viii. fig. 2).

Internally there is also notable agreement: the shape of the calcareous ring, the short retractors, the course of the intestine, etc. In the case of the larger individuals of *nocturna* the gonads are also hermaphroditic as in Heding's material. Incidentally this is also the case in the closely related form *S. abyssorum* Théel, where also the calcareous ring is of the same type as in *Psollicucumis*. As for the respiratory trees, most of the specimens of *S. nocturna* show signs of having regenerated the anal end or having recently suffered injury, as the anus is small with no distinct anal papillæ and in some cases no well-defined cloaca. In one specimen, however, the bases of two large respiratory trees are present (presumably the specimen which Sluiter examined), and that individual shows also a large anus with well-developed anal papillæ (individual from Sta. 284).

The name *Psollicucumis apneumona* Heding must therefore be relegated to the synonymy of *Staurocucumis nocturna* (Sluiter). Very likely Ohshima's species, *S. sluiteri*, from south of Honshu, 800–1200 metres, may also prove to be a synonym of *S. nocturna*. It was based upon specimens 11 mm. long. Ohshima saw the close resemblance to *S. nocturna*, but, as Sluiter's species

was supposed to have small ventral tentacles and coarser knobbed crosses besides the smooth long-armed ones, he felt that these were sufficient differences to warrant a new species. Both *S. sluiteri* and *S. nocturna* were placed in *Staurocucumis* by Ekman in 1927, close to *S. abyssorum*.

The question which naturally presents itself is whether *abyssorum* and *nocturna* are different species or possibly represent two varieties, viz., a continental form and an abyssal form. It is well known that young individuals of *S. abyssorum* have almost smooth crosses with long arms (var. *hyalina* Théel, 1886; see also Ludwig, 1894), while older individuals have mostly coarser, short-armed deposits with spines. A similar change is found in *S. nocturna*, and seems to be the normal course of development in the genus *Staurocucumis* (see Ekman, 1927, diagnosis).

No specimens are available to us of the young form of *S. abyssorum* (*hyalina*-stage), the smallest individual which we have examined measuring 4–5 cm., but critical study of the material in hand results as follows:—

The abyssal form, *S. abyssorum*, reaches typically a length of about 10 cm., while the continental form, *S. nocturna*, measures less than 5 cm.; the former has the feet arranged in distinct double or zigzag rows on all the ambulacra, at least in specimens 4–5 cm. long, while even the largest *nocturna* has few and widely-spaced dorsal appendages, though with crowded ventral feet. The internal anatomy of the two forms is practically identical; *abyssorum* (large specimens) has much longer tubes in the male portion of the gonads than has *nocturna*; the ovaries seem on the other hand to be about equally large. The calcareous ring is of the same type in both forms, with the peculiar "windows" in the radial pieces described by Heding. Also the course of the intestine, the length of the retractors, and the position of the gonads show close similarity. The respiratory trees are well developed in *abyssorum* and firmly attached to the dorsal muscle-bands. In *nocturna* it seems as if these organs are more delicate, with few branches (*vide* Sluiter), and most likely never well attached to the integument. Comparison of the spicules shows that *abyssorum* has larger, more irregularly developed crosses with tendency to very eccentric placement of

the outer projection, the latter often reduced, and one arm of the cross spinous; in the feet the supporting rods are formed by modification of crosses as if the two arms had moved closer and closer until united to form one short arm with a basal perforation; the tentacles have rods similar to those found in the feet. In *nocturna* on the other hand, the crosses are regularly developed; the feet have delicate curved rods, simple or with a slender arm, and the tentacles have besides the characteristic enormous thick smooth curved rods (described by both Sluiter and Heding) smaller spicules of the same type, sometimes with a short simple projection.

Although it seems clear, from this detailed comparison, that the two species are closely allied, they are evidently best treated as distinct. As far as now reported, *abyssorum* comes from many localities in the Indo-Pacific (Théel, Ludwig, Clark) and also from the Atlantic Ocean, where the specimens hitherto reported seem to have been small with "hyalina" spicules only [Marenzeller, Grieg, Mortensen ("*Cucumaria ingolfi*" Deichm., from south of Iceland)], from depths of 2470 to 4025 metres. Ekman's specimens from the Antarctic (1927) seem slightly different from the typical form. On the other hand, *nocturna* is known from the Malay Archipelago, 204 to about 1200 metres (Sluiter, Heding), whereas *sluiteri* was taken south of Honshu, Japan, in about 800-1200 metres (Ohshima).

The genus *Staurocucumis* has no special affinities with the genus *Psolidium*. Heding's suggestion that *P. arcuatum* and *convergens* Hérouard resemble *Psollicucumis* "to a rather striking degree" is simply inexplicable. Those species have numerous feet dorsally, scattered over the whole surface, and the spicules are of an entirely different type. The appearance which "recalls that of a *Psolus*" in the specimens which Heding named *Psollicucumis* is accidental, caused by uneven contraction of the body-wall and the unusually forward position of the large gonads. By no means can one say that the trivium is "flattened to a creeping-sole" in any specimens of *Staurocucumis* that we have seen, the word creeping sole being taken in the sense in which it is used in the typical members of the genus *Psolus*, *Psolidium*, *Thyonepsolus*.

REFERENCES.

- (1) HEDING, S. G. 1934. "On a new Dendrochirote Holothurian from off Timor." *Ann. & Mag. Nat. Hist.* ser. 10, vol. xiii. pp. 456-464, pl. xvi. 2 text-figs.
- (2) EKMAN, S. 1927. 'Holothurien der Deutschen Sudpolar-Expedition,' vol. xix., *Zool.* 11, pp. 361-419, 18 text-figs. (Gives references to the papers mentioned in this review, except Mortensen's Handbook of the Echinoderms of the British Isles, 1927, Oxford Univ. Press.)

Museum of Comparative Zoölogy,
Cambridge, Mass., U.S.A.,
January 18, 1936.

LX.—*New Species of Nusalala (Neuroptera, Hemerobiidæ)*. By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

THROUGH the kindness of Dr. L. Berland, I have been able to examine the type of *Nusalala erecta* Navás, which is the type of the genus *Nusalala*. Contrary to the diagnosis given by Navás, I find that in the costal area of the anterior wing there is a small but definite recurrent vein. Esben-Petersen's genus *Haarupiella* was differentiated from *Nusalala* by the presence of a recurrent vein. Consequently there is now no character with which to separate the two genera, and *Haarupiella* must therefore be placed in the synonymy of *Nusalala*.

This combination of the two genera brings the number of described species of *Nusalala* up to thirteen. Many of these species are known from the female sex only, and in no case has any attempt been made to use the genitalia for diagnostic purposes. Examination of a series of species reveals that there is considerable variation in venation, particularly in the number of cross-veins in the gradate series, even on opposite sides of the same insect.

Thus it is very probable that some, at least, of the described species will prove to be synonyms when more is known of them. Good specific characters may be found in the male genital structures, and possibly in the female also. Examination of these structures necessitates the removal of the abdomen and its treatment with KOH, but the characters so obtained are more than worth the trouble involved. The drawings in the paper have been made from specimens so treated, whilst still in fluid and before mounting in Canada Balsam.

NUSALALA Navás.

Navás, Mission Amer. Sud, x. fasc. 1, p. 75 (1913).

= *Haarupiella* Esben-Petersen, Notes Leiden Mus. xxxvi. p. 263 (1914).Genotype : *Nusalala erecta* Navás.

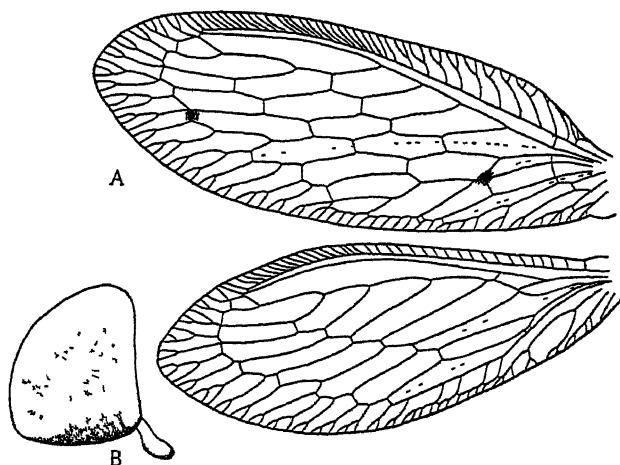
Costal area constricted at base, with a small but distinct recurrent vein in the fore wing. One cross-vein at the base of the subcostal area. Radius in fore wing with four or five branches, apical branch with several forks. Medius forks opposite the first or second branch of the radius. Basal cross-vein between R_s and M_1 at about one-third from base of wing. M_2 and Cu_1 coalesce for a short distance. Three series of gradate veins in the fore wing, two series in the hind wing. Two false origins to the radial sector in the hind wing. Medius bent towards cubitus, but not coalescing.

Nusalala erecta Navás. (Fig. 1.)

Mission Amer. Sud. x. fasc. 1, p. 75 (1913).

To supplement Navás's description, I am figuring the wings of the ♀ type in the Paris Museum and also the

Fig. 1.

*Nusalala erecta* Navás.

A, left wings of ♀ type ; B, eighth sternite, lateral.

eighth sternite, or subgenital plate. This is U-shaped in cross-section, with a pigmented pattern as shown in fig. 1 B. From the centre of its apical margin arises a narrow

tongue-like process, whose apical margin is rounded and grooved on its upper surface.

Nusalala navási, nom. nov.

Nusalala gradata Navás, Rev. Russe ent. xxiv. p. 195 (1930). This name is pre-occupied by *N. gradata* (Navás), 1925.

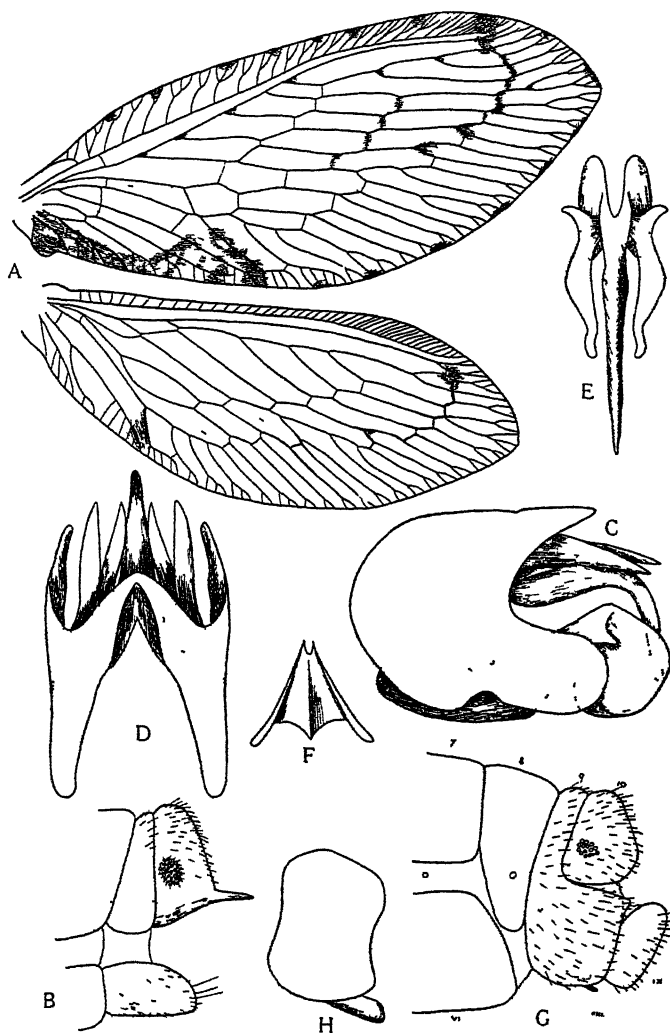
Nusalala championi, sp. n. (Fig. 2.)

♂.—Head fulvous, with black markings; antennæ fulvous, basal joint large, with a black spot internally at the base. Pro-, meso-, and metathorax dark fulvous. Legs pale, femora and tibiæ of the anterior and median legs each with two blackish spots.

Membrane of the wings hyaline, marked with brownish as in fig. 2 A; longitudinal veins pale, with brownish streaks at the origins of the radial branches and within the brownish areas of the wing-membrane; median and outer gradate series in anterior wing, and outer series in posterior wing, brown. In the anterior wing the radius generally has five branches, sometimes six, and in one example only four. Number of cross-veins in the gradate series between the branches of the radius, inner four to five, median four, and outer six to eight. Posterior wing with six branches to the radial sector. Four cross-veins in the inner and six or seven in the outer gradate series between the radius and its branches.

Genitalia.—Superior appendages short and broad, lower apical angle bearing an acute spine. This spine arises from an apodeme along the lower margins of the superior appendage and ninth tergite, and extending basally into the eighth segment. Ninth tergite divided dorsally. Margin of the ninth sternite somewhat produced and rounded. Tenth sternite from the side large, rounded basally, and with a large excision apically. From above the two halves are joined by a narrow bridge. Within the tenth sternite there arise three pairs of spines and a downcurved median hook. Two pairs of spines are long and conspicuous, whilst the third paired spine is short, concealed beneath the others, and best seen in side view. The median hook is broad at its base and tapers to a rounded apex. Parameres with long, fused, blade-like bases, and apices in the form of flattened lobes. Near the apex on each side there arises a bifurcate

Fig 2.



Nusalala championi, sp. n. A-F, ♂; G-H, ♀.

A, right wings; B, apex of abdomen, lateral; C, tenth sternite and parameres, lateral; D, tenth sternite, dorsal; E, parameres, dorsal; F, hypandrium, ventral; G, apex of abdomen, lateral; H, eighth sternite, lateral.

process, the apical fork short, the basal one long and sinuous. Hypandrium sagittate, apex with a narrow excision, margins reflexed.

♀ *Genitalia*.—Ninth tergite divided dorsally as in ♂, narrow in its upper half, broad beneath, enclosing two sides of the pear-shaped tenth tergite or superior appendage. Eighth sternite (subgenital plate) consisting of a pair of upright quadrate plates, a narrow tongue-like process with excised apex arising from the membrane between them. Ninth sternite in the form of a pair of ovate lobes.

	mm.
Length of anterior wing	9.5
„ posterior wing	8.2

Guatemala: Las Mercedes, 3000 ft., ♂ type, 2 ♂♂, 1 ♀ paratypes; Cerro Zunil, 4000–5000 ft., 1 ♂ paratype; Panajachel, 5000 ft., ♀ allotype. Panama: Volcan de Chiriqui, 2000–5000 ft., 1 ♂, 1 ♀, 1 ? paratypes.

All collected by Mr. G. C. Champion and part of the Godman and Salvin Collection in the British Museum.

I have been unable to reconcile this species with any of the described species, some of which are insufficiently described, and I think it better to deal with it as a new species. I have selected as ♀ allotype an example from Panajachel, as the ♀ from Las Mercedes is smaller and is somewhat aberrant in neurulation.

Nusalala uncata, sp. n. (Fig. 3.)

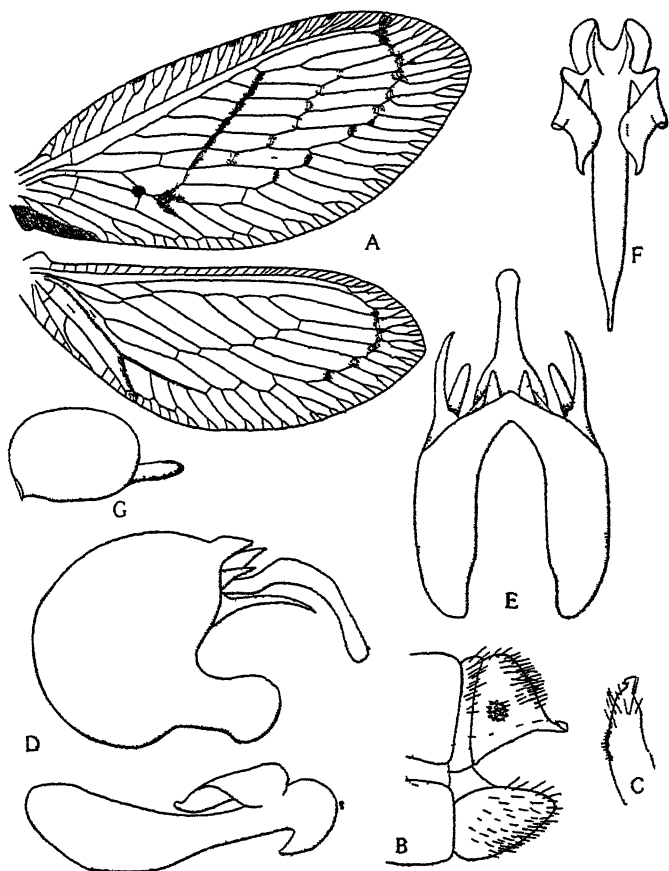
♂.—Ground-colour tawny, marked with dark brown. Basal joints of antennæ brownish, remainder tawny. Prothorax brownish. Anterior and median legs marked with brownish as in other species in the genus.

Anterior wing with membrane hyaline, much pale brown irroration, and marked with darker brown as in fig. 3 A. The median and some of the outer gradate veins with a rounded whitish spot in the brown area. Six branches to the radius, medius forked beyond the basal branch of the radius. Posterior wing hyaline, outer gradate veins clouded with brownish, some with whitish centres, and the cubitus shaded with brownish. Radial sector with five branches. Number of gradate veins between the radius and its branches: anterior

wing, inner five, median six, outer seven; posterior wing, inner four, outer six.

Genitalia.—Superior appendages broadly triangular, apex bearing a slender spine terminating in an angular

Fig. 3.



Nusalala uncata, sp. n. A-F, ♂; G, ♀.

A, right wings; B, apex of abdomen, lateral; C, right superior appendage, dorsal; D, tenth sternite and parameres, lateral; E, tenth sternite, dorsal; F, parameres, dorsal; G, eighth sternite, lateral

hook. Ninth sternite produced and rounded. Tenth sternite with three pairs of spines and a median hook.

The outer paired spine long, slender, slightly down-curved, the two inner pairs short and stout. Median hook downcurved, its apex slightly dilated and rounded. Parameres fused for nearly their whole length, apices in the form of two rounded lobes, hook-like from the side, with a rounded excision between them. Lateral projections in the form of elongate sinuous plates, curved spirally upward and inward. The hypandrium could not be found and was apparently lost in preparation.

♀.—Lateral plates of the eighth sternite longer than deep, much as in *rhegmatica*, but without the excision in the margin that occurs in that species.

	mm.
Length of anterior wing	9
„ posterior wing	8

Panama: Volcan de Chiriqui, 2000–3000 ft. (*G. C. Champion*).

♂ holotype, ♀ allotype in the British Museum.

Nusalala rhegmatica Navás. (Fig. 4.)

Nusalala rhegmatica Navás, *Broteria*, xii. p. 228 (1914).

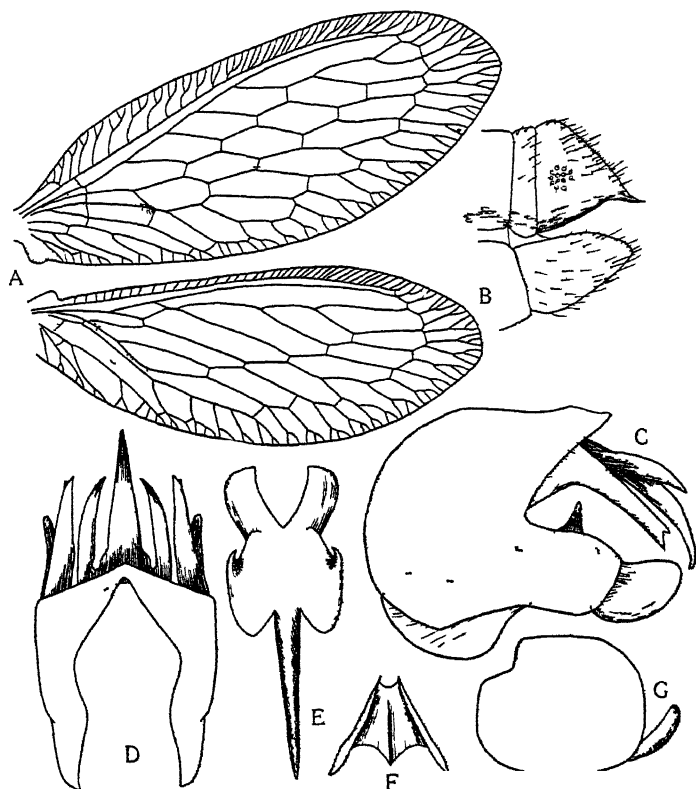
Haarupiella rhegmatica (Navás) Esben-Petersen, *Notes Leiden Mus.* xxxvi. p. 264 (1914).

I have before me a series from Central America which I believe to be this species. There is some variation in venation, particularly in the number of gradate veins between the radius and its branches: anterior wing, inner three to four, median one to four, outer six; posterior wing, inner two to four, outer five to six. These figures are based on the examination of eight examples. As the genitalia of this species has not been figured, I take this opportunity of doing so.

♂.—Ninth tergite divided dorsally. Superior appendages triangular in lateral view, the apex armed with a short acute spine, arising from an elongate apodeme as in *N. championi*. Ninth sternite broad at its base, somewhat acute apically. Tenth sternite similar to that in *championi*, but with only two pairs of spines and a median hook. The outer paired spine is nearly straight, directed obliquely downwards, its apex bifid. The inner spine is slightly curved, tapering to an acute apex. Median hook less curved than in *championi*, its apex

more tapered and acute. Parameres similar in structure, apices somewhat forcipate in dorsal aspect, ovate in lateral view. From the dorsal surface, in the apical half, arises a pair of horizontally-disposed ovate plates, with

Fig 4



Nusalala rhegmatica Navás. A-F, ♂; G, ♀.

A, right wings; B, apex of abdomen, lateral; C, tenth sternite and parameres, lateral, D, tenth sternite, dorsal, E, parameres, dorsal, F, hypandrium, ventral; G, eighth sternite, lateral

their outer margins produced upwards to form acute spines. Hypandrium sagittate, apex rather broader, and with a wider excision.

♀—Ninth and tenth tergites, and ninth sternite, much as in *N. championi*. Apex of the eighth sternite

more excised, the quadrate lateral plates longer than deep (deeper than long in *championi*).

Type-locality.—Paraguay: San Bernardino, 3 de Mayo, 21 de Junio.

Type in Munich Museum.

The 3 de Mayo example is a male, but at the time the specimen was before me (1927) I was unable to make a preparation of the genitalia.

Further examples from Costa Rica, Irazu (*Rogers*); Guatemala, Quiché Mts., 7000–9000 ft.; Capetillo; San Gerónimo; Cerro Zunil, 4000–5000 ft.; San Joaquin; Dueñas (*G. C. Champion*).

List of Species of the Genus Nusalala.

- N. camposina* Navás. Ecuador.
Rev. Chil. Hist. Nat. xxxii. p. 112 (1928).
- N. championi*, sp. n. Guatemala, Panama.
- N. colombiensis* (Bks.). Colombia.
Boriomyia colombiensis Banks, Proc. Ent. Soc. Wash. xii. p. 157 (1910).
- N. damiensis* Smith. Haiti.
Ann. Ent. Soc. Amer. xxiv. p. 800 (1931).
- N. erecta* Navás. Ecuador.
Mission Amer. Sud, x. fasc. 1, p. 75 (1913).
- N. escomeli* Navás. Peru.
Ann. Soc. Sci. Brux. xli. p. 255 (1922).
- N. gradata* (Navás). Brazil.
Haarupiella gradata Navás, Mitt. münch. ent. Ges. xv. p. 66 (1925).
- N. infirma* Navás. Jamaica.
Mem. R. Ac. Ci. Barcelona, xi. 8, p. 117 (1914).
- N. marginata* Navás. Costa Rica.
Broteria (Zool.), xxiii. p. 85 (1926).
- N. navási*, nom. nov. Siberia.
Nusalala gradata Navás, Rev. Russe ent. xxiv. p. 195 (1930).
- N. neotropica* (Esb.-Peters.). Bahia.
Haarupiella neotropica Esben-Petersen, Notes Leiden Mus. xxxvi. p. 263 (1913).
- N. pallida* (Esb.-Peters.). Argentina.
Haarupiella pallida Esben-Petersen, Notes Leiden Mus. xxxvi. p. 265 (1913).
- N. rhegmatica* Navás. Paraguay, C. America.
Broteria, xii. p. 228 (1914).
- N. uncata*, sp. n. Panama.
- N. uruguayana* (Navás). Uruguay.
Haarupiella uruguayana Navás, Arx. Inst. Ci. Barcelona, vii. p. 193 (1923).

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 102. JUNE 1936.

LXI.—*The Hemiptera of Christmas Island.* By R. J. IZZARD, Department of Entomology, British Museum (Nat. Hist.).

THIS paper is based on a collection made by Dr. F. Harms during the first four months of 1933. It has been thought advisable, however, to collect together all the previously known records for the Island, so that the list will be more or less complete.

The first species of Hemiptera from Christmas Island were collected in 1887 by J. J. Lister, the naturalist accompanying H.M. Surveying-ship 'Egeria.' These were described by W. F. Kirby in the Proceedings Zool. Soc. p. 553 (1888), and consisted of five species, all new.

In 1900 the Trustees of the British Museum published a monograph of Christmas Island based on the collections made by the late Dr. C. W. Andrews. The Hemiptera were again worked out by Kirby, who recorded twelve additional species, ten of which were new to science. Kirby only included the more easily determined species in his report, and stated that about twice as many species were represented in the collections than were noticed in his paper. The following year Distant recorded in the 'Annals and Magazine of Natural History,' (7) viii. pp. 465-507, seven more Lygaeids from Andrews's material including five new species, thus bringing the total to

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 39

24 species, all except five (*Geotomus pygmæus* Dall. (= *Æthus nitens* Kirby), *Lamprodema coleopteroides* Walk., *Orthæa vincta* Say, *Halobates princeps* B. White, and *H. proavus* B. White) being endemic. The present collection contains seventeen of these species (seven not having been retaken by Dr. Harms), and an additional thirty species were also collected. Two additional species have herein been described from Dr. Andrews's material, bringing the grand total to 56 species, not including two with localities probably not Christmas Island (nos. 35 and 44). Of these 28 are apparently endemic. The remaining 28 are composed of 10 species widely distributed in the Oriental and Australasian regions, six species restricted to the Malaysian subregion, four restricted to the Austro-Oriental subregion, six restricted to the Indian and Ceylonese subregions, one Indo-Chinese species, and one of doubtful origin (*Fulvius brevicornis* Reut.), probably cosmopolitan. It would thus appear that Christmas Is. has derived its fauna both from the East and the West. According to Andrews the Austro-Oriental (Austro-Malayan) species arrived by means of the equatorial drift current from the Timor Sea. The Malaysian (Indo-Malayan) species were driven across from Java during northerly gales. The presence of an Indian and Ceylonese element is not explained by Andrews, but these forms must have had a much earlier origin than the other elements.

My thanks are due to Mr. W. E. China for his invaluable assistance and drawings.

HEMIPTERA.

HETEROPTERA.

Family Cydnidæ.

1. *Geotomus pygmæus* (Dallas).

Æthus pygmæus Dallas, List Hemipt. Brit. Mus. i. p. 120 (1851).

Æthus nitens Kirby, Mon. Christmas Is. p. 127, pl. xv. fig. 1 (1900).

Geotomus pygmæus Signoret, Ann. Soc. Ent. France, (6) iii. p. 51, t. 3, fig. 160 (1883).

Indian Ocean: Christmas Island, 7 specimens, i.-iv. 1933 (F. Harms).

Widely distributed over whole Oriental region, extending northwards to Japan and eastwards to the Marquesas.

Family Pentatomidæ.

2. *Cantao ocellatus* (Thunberg).

Cimex ocellatus Thunberg, Nov. Ins. Sp. iii. p. 60, fig. 72 (1784).

Cantao ocellatus Distant, Faun. Brit. India, Rhyn. i. p. 43, fig. 18 (1902).

Indian Ocean: Christmas Island, Shore Terrace, 1 specimen (*F. Harms*).

Distribution.—India, Assam, Burma, Ceylon, Cochin China (Haulik and Hong Kong), Formosa; Philippines; Sumatra; Malay Pen., Timor; Papua; and Java.

3. *Plautia grossepunctata* (Kirby).

Pentatoma grossepunctata Kirby, Mon. Christmas Is. p. 128, pl. xv. fig. 2 (1900).

Plautia grossepunctata Kirkaldy, Cat. Hem. Het. i. p. 125 (1909).

Indian Ocean: Christmas Island, 5 specimens, i.–iv. 1933 (*F. Harms*).

This is apparently an endemic species.

Family Coreidæ.

4. *Leptocoris subrufescens* (Kirby).

Lygæus subrufescens Kirby, Proc. Zool. Soc. London, p. 553 (1888).

Leptocoris (*Serine'ha*) *subrufescens* Bergroth, Mem. Soc. Ent. Belg. xxii. p. 165 (1913).

Indian Ocean: Christmas Island, 11 specimens, i.–iv. 1933 (*F. Harms*).

This is apparently an endemic species.

Family Dysodliidæ.

5. *Mezira lignicola* (Kirby).

Brachyrhynchus lignicolus Kirby, Mon. Christmas Is. p. 129, pl. xv. fig. 4 (1900).

An endemic species not taken by Dr. Harms.

6. *Mezira membranacea* (Fabricius).

Acanthia membranacea Fabricius, Ent. Syst. Suppl. p. 526 (1797).

Mezira membranacea China, 'Insects of Samoa,' pt. ii. fasc. 3, p. 103 (1930).

Indian Ocean: Christmas Island, 12 specimens, i.–iv. 1933 (*F. Harms*).

Widely distributed over the Indian, Indo-Chinese, Malaysian, and Philippine subregions.

Family *Lygædiæ*.7. *Nysius spectabilis* Dist.

Nysius spectabilis Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 465 (1901).

An endemic species not taken by Dr. Harms.

8. *Nysius andrewsi*, sp. n.

Colour.—Head black covered with silvery pubescence, a broad stripe between ocelli extending to apex of each of the juga brown, tylus and a small spot between ocelli yellow; bucculæ whitish yellow, gula on each side below the antenniferous tubercle pale yellow; antennæ pale yellow, fourth segment fuscous; rostrum ferruginous-brown, becoming black apically. Pronotum dull yellow with a broad transverse fascia across the anterior disc extending on each side to the anterior lateral angles, and a spot on each of the humeral angles black, a central and two lateral longitudinal fasciæ on posterior lobe dull brown. Scutellum yellowish brown, the basal margin and a longitudinal central fascia black, extreme apex yellow. Sternum black, the anterior margin of prosternum, the acetabulæ and posterior margins of meso- and metasternum, and the odoriferous orifice whitish yellow, the metapleura brownish shading to black laterally. Hemelytra hyaline, the claval commissure and three elongate stripes along apical margin of corium dark brown; membrane hyaline. Venter black (♂) with a short transverse fascia on fourth segment pale yellow, the whole covered with dense fine silvery pubescence. Abdomen of ♀ pale yellow with dark markings on lateral margins.

Structure.—Head moderately deflexed, a little more than half as long as wide across eyes (30 : 55), with the ocelli much nearer to eyes than to each other, rugosely punctate. Relative lengths of antennal segments 15 : 38 : 35 : 30, last segment fusiform. Rostrum terminating between the hind coxæ; bucculæ reaching to a line drawn between middle of eyes. Pronotum anteriorly a little wider than long in middle, posteriorly one and three-fifths as wide as the anterior margin; strongly punctate, calli smooth impunctate; scutellum strongly punctate, except for a median lævigata ridge. Pleura

sparsely punctate, posterior margin of metasternum laminate and broadly emarginate, the outer angles angularly rounded; costal margin of corium slightly dilated, widening apically. Abdomen below shining impunctate; femora slightly incrassate, tibiæ simple, tarsi with basal joint as long as the remaining two together, fringed with pale hairs.

Total length, ♂, 3.14 mm., width across humeral angles 0.8 mm.; ♀, 3.66 mm., width across humeral angles 1.10 mm.

Indian Ocean: Christmas Island, 1 ♂ (type), i.-iv. 1933 (*F. Harms*); 21 specimens (paratypes), i.-iv. 1933 (*F. Harms*).

This species is allied to *N. spectabilis* Dist., but differs in the shorter head and bucculæ, and the colour-pattern on the pronotum, as well as the different markings on the hemielytra and the relative length of the antennal segments.

This species is dedicated to Dr. Andrews in recognition of his early work on the Christmas Island fauna.

9. *Nysius dissimilis*, sp. n.

Colour very similar to the preceding species, but this species differs in the following structural points:—

Head somewhat longer than in *andrewsi*, although having the same ratio to the width across eyes (38:60) the length of the antennal segments are generally shorter (10:29:30:28). The bucculæ are a little shorter and narrowed more sharply towards their apices; the pronotum is somewhat narrower across the humeral angles, and the outer angles of the posterior margin of metasternum longer and more gradually rounded; the costal margin of corium straight along its basal third, and thence suddenly and obliquely widening to form the dilatation.

Total length, ♂, 3.11 mm., width across humeral angles 1 mm.; ♀, 3.36 mm., width across humeral angles 1.8 mm.

Indian Ocean: Christmas Island, 1 ♂ (type), i.-iv. 1933, 2 specimens, i.-iv. 1933 (paratypes) (*F. Harms*).

10. *Geocoris vestitus* Dist.

Geocoris vestitus Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 471 (1901).

An endemic species, not taken by Dr. Harms.

11. *Geocoris jucundus* (Fieber).

Ophthalmicus jucundus Fieber, Wien. ent. Mon. v. p. 270 (1861).

Geocoris jucundus Lethierry et Severin, Cat. Hemipt. t. 2, p. 171 (1894).

Indian Ocean: Christmas Island, 10 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—India.

12. *Orthæa undulata* (Dohrn).

Plociomerus undulata Dohrn, Stett. ent. Zeit. xxi. p. 404 (1860).

Pamera undulata Lethierry et Severin, Cat. Hemipt. t. 2, p. 194 (1894).

Indian Ocean: Christmas Island, 28 specimens, i.-iv. 1933 (*F. Harms*); 4 specimens, Shore Terrace, N.E. Point, 28. i. 1933 (*F. Harms*).

Distribution.—Ceylon.

13. *Orthæa nietneri* (Dohrn).

Plociomerus nietneri Dohrn, Stett. ent. Zeit. xxi. p. 404 (1860).

Pamera nietneri Stål, Enum. Hem. iv. p. 151 (1874).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*).

Distribution.—Ceylon, Burma, Java, Philippines, Fiji, Samoa.

14. *Orthæa vineta* (Say).

Pamera vineta Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 481 (1901).

Recorded from Christmas Island by Distant, but specimens cannot now be found.

15. *Orthæa andrewsi* (Dist.).

Pamera andrewsi Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 481 (1901).

Indian Ocean: Christmas Island, 3 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—Indian Ocean and Fiji.

16. *Orthæa insignis* (Distant).

Pamera insignis Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 481 (1901).

Indian Ocean: Christmas Island.

An endemic species, not taken by Dr. Harms.

17. *Bedunia nesiotes* Kirk.

Bedunia nesiotes Kirkaldy, Proc. Linn. Soc. N.S. Wales, xxxiii. p. 357 (1908-09).

Indian Ocean : Christmas Island, 1 specimen, i.-iv. 1933 (F. Harms).

Distribution.—Fiji, Navua.

18. *Lamprodema coleopteroides* (Walk.).

Rhyparochromus coleopteroides Walker, Cat. Hem. Het. pt. 5, p. 108 (1872).

Indian Ocean : Christmas Island, 26 specimens, i.-iv. 1933 (F. Harms).

Distribution.—Ceram.

19. *Lethæus maculatus* Dist.

Lethæus maculatus Distant, Ann. & Mag. Nat. Hist. (7) viii. p. 507 (1901).

Indian Ocean : Christmas Island.

An endemic species, not taken by Dr. Harms.

Family Reduviidæ.

20. *Empicoris rubromaculatus* (Blackb.).

Ploiariodes rubromaculata Blackburn, Proc. Linn. Soc. N.S. Wales, (2) iii. p. 349 (1889).

Ploiariodes euryale Kirkaldy, Proc. Linn. Soc. N.S. Wales, xxxiii. p. 372 (1908).

Ploiariodes californica Banks, 'Psyche,' xvi. p. 46 (1909).

Ploiariola froggatti Horvath, Ann. Mus. Nat. Hung. xii. p. 643, fig. 5 (1914).

Empicoris rubromaculatus McAtee & Malloch, Proc. U.S. Nat. Mus. lxvii. 1, p. 16 (1925).

Indian Ocean : Christmas Island, 1 specimen, i.-iv. 1933 (F. Harms).

Distribution.—California, Missouri, Florida, Virginia, Porto Rico, Brazil (Madeira ?), N.S. Wales, New Zealand, Fiji, Hawaii, and Samoa.

21. *Physoderes impeza* (Dist.).

Epinodera impeza Distant, Ann. Soc. Ent. Belg. p. 56 (1903).

Indian Ocean : Christmas Island, 1 specimen, 28. i. 1933 (F. Harms).

Distribution.—Burma, Tenasserim, Tonkin.

22. *Peregrinator biannulipes* (Montr. et Sign.).

Opiscætus biannulipes Montrouzier et Signoret, Ann. Soc. Ent. France, (4) i. p. 69 (1861).

Microcleptes biannulipes Stål, Kongl. Svensk. Vet.-Ak. Handl. xii. 1, p. 79 (1874).

Reduvius laniger Butler, Ann. & Mag. Nat. Hist. (4) xvii. p. 411 (1876)

Allæocranum biannulipes Kirkaldy, Proc. Linn. Soc. N.S. Wales, xxxiii. p. 369 (1908).

Peregrinator biannulipes China, Ann. & Mag. Nat. Hist. (9) xv. p. 164 (1925).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*).

Recorded from Central America, Cuba, Renunion, Rodriguez, Philippines, New Caledonia, Fiji, and Samoa. Apparently widely distributed.

Family Mesoveliidæ.

23. *Mesovelia orientalis* Kirk.

Mesovelia orientalis Kirkaldy, Ann. Mus. Genov. xl. p. 808 (1900).

Indian Ocean: Christmas Island (immature forms in spirit), i.-iv. 1933 (*F. Harms*).

Distribution.—Ceylon, Sumatra, Java, Lombok, Philippines, Formosa, and New Guinea.

Family Nabidæ.

24. *Reduviolus capsiformis* (Germ.).

Nabis capsiformis Germar, Silbermann, Rev. Ent. v. p. 132 (1837).

Reduviolus innotatus B. White, Ann. & Mag. Nat. Hist. (4) xx. p. 112 (1877).

Reduviolus sp., ? Kirkaldy, Proc. Linn. Soc. N.S. Wales, xxxiii. p. 366 (1908).

Reduviolus capsiformis Reuter, Mem. Soc. Ent. Belg. xv. p. 114 (1908) (synonymy); Kirkaldy, Faun. Hawaii Hemipt. Suppl. p. 546 (1909).

Indian Ocean: Christmas Island, 8 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—Europe, Africa, N. America, and Pacific region.

Family Capsidæ.

25. *Trigonotylus dohertyi* (Dist.).

Megaloceræa dohertyi Distant, Faun. Brit. India, Hem. ii. p. 425 (1904).

Indian Ocean: Christmas Island, 23 specimens, i.-iv. 1933; 20 specimens, Shore Terrace, N.E. Point, i.-iv. 1933 (*F. Harms*).

Distribution.—India.

26. *Creontiades pallidifer* (Walk.).

Capsus stramineus Walker, Cat. Het. vi. p. 120 (1873).

Capsus pallidifer Walker, nom. nov., Cat. Het. vi. p. 199 (1873).

Kangra dudgeoni Kirkaldy, Trans. Ent. Soc. London, p. 257 (1902).

Megacælum stramineus Distant, Faun. Brit. India, Hem. ii. p. 428 (1904).

Creontiades stramineus Poppius, Öfv. Finska Vet. Soc. Forh. liii.

Afd. A, no. 2, p. 11 (1911); Poppius, Archiv f. Naturges. lxxx.

Abt. A, p. 14 (1915).

Indian Ocean: Christmas Island, 5 specimens, i.-iv. 1933
(F. Harms).

Distribution.—India, Ceylon, Java, Formosa, and widely throughout the Pacific regions.

27. *Lygus aldrichi*, sp. n.

Colour.—♀. Pale yellow, with eyes and apical fifth of second antennal segment black; sides of apical half of clypeus, first antennal segment, basal fourth of second segment, apical two-thirds of third segment, a broad stripe down claval and corial commissure extending on to apical half of scutellum, a rather pallid suffusion towards apex of corium, membranal veins, and an obscure stripe down each side of venter, all brown, base of third segment pallid (fourth missing); cuneus immaculate; some obscure very pale brown markings on apical third of hind femora and bases of tibiæ. The whole insect covered with more or less dense semi-erect golden pubescence.

Structure.—♀. Head about one-fourth shorter than pronotum; vertex not carinate along base; relative length of antennal segments 26:75:45:—; rostrum extending beyond the middle coxæ, but barely reaching the hind coxæ. Pronotum strongly punctate, sides almost straight, the anterior collar not quite as thick as the first antennal segment at apex; scutellum smooth and shining. Hemelytra distinctly and regularly punctate; costal margin somewhat dilated; underside of femora with a row of long fine hairs; hind tibiæ without spine-like bristles.

Total length 4.2 mm., width 1.26 mm.

Indian Ocean: Christmas Island, 1 ♀ (type), i.-iv. 1933
(F. Harms).

Runs down to *rambeensis* in Poppius's key*, but differs in the following characters:—Without the brown markings on either side of the calli and the cuneus. The vertex is without a furrow, the first antennal segment is only half the length of the head and the second segment a little more than three times length of first. The tibiae are covered with dense hairs, but not spines, and the width across humeral angles is somewhat less than in *rambeensis*.

This species is dedicated to Captain Pelham Aldrich, R.N., in consequence of whose discoveries on the Island in 1887 it was formally annexed to the British Crown in 1888.

28. *Lygus murrayi*, sp. n.

Colour.—♀. Golden brown; head towards apex more or less suffused with red; eyes black; antennae pale yellow; rostrum pale yellow with extreme apex black. Apex of embolium, base of cuneus, inner margin, and apex of cuneus all red; apex of corium suffused with dark brown; membrane infumate with a large spot in basal cell and another between outer cell and costal margin hyaline; veins pale. Dorsal surface of abdomen dark brown, margins pale yellow. Venter pale yellow, a brown spot in middle of base, tip of abdomen red. Legs pale yellow, some indistinct broken brown annulation at apices of femora; spines of tibiae and last tarsal segment with claws brown. The whole insect covered with golden depressed pubescence.

Structure.—♀. Head seen from front about one-fifth shorter than pronotum (16 : 19), vertically deflexed, vertex with a sharp edge posteriorly between eyes overhanging the neck; eyes transverse, overlapping anterior margin of pronotum at sides; relative length of antennal segments 11 : 37 : 22 : —; the first segment shorter than head seen from front; rostrum extending to hind coxæ, first segment swollen. Pronotum very finely and obscurely punctate, about twice as wide across humeral angles as across anterior collar, sides straight, anterior collar slightly thinner than second antennal segment at base. Scutellum transversely wrinkled. Hemelytra very finely and obscurely punctate, costal margin feebly convex, embolium

* Ann. Mus. Nat. Hung. xii. p. 382 (1914).

very narrow. Underside of hind femora with a few long fine hairs; hind tibiæ with strong, spine-like, brown bristles arising from brown spots.

Total length 4 mm., width across humeral angles 1.25 mm.

Indian Ocean: Christmas Island, 2 ♀♀ (including type), i.-iv. 1933 (*F. Harms*).

1 ♀, North Coast, Jan. 1898, 1 ♀, Murray Hill, 26-28. ix. 1908 (*C. W. Andrews*).

Runs down in Poppius's key* to *L. muiri* Popp. from Fiji, to which it is closely allied. Differs in strongly carinate posterior margin of vertex, absence of longitudinal furrow on vertex, and in slightly different colour-pattern without black tip to cuneus.

Dedicated to Sir John Murray in recognition of his distinguished association with Christmas Island.

29. *Fulvius brevicornis* Reut.

Tetratodella anthocoroides Reuter, Bihang Svensk. Vet.-Ak. Handl. iii. no. 1, p. 8 (1875) (nec Stål, 1862).

Fulvius brevicornis Reuter (nom. nov.), Ent. Tidsk. xvi. p. 135 (1895).

Indian Ocean: Christmas Island, 2 specimens, i.-iv. 1933 (*F. Harms*).

This species has so far only been recorded from the French port Rouen, where it was said to have been imported by ships from Senegal. The Christmas Island specimens agree very well indeed with Reuter's description, and the differences are not sufficient to warrant description of a new species. It seems very doubtful whether *F. brevicornis* really came from Senegal, although a species which can travel in ships is likely to be a cosmopolitan one. Unfortunately, no males of the Christmas Island species are available for comparison with those collected at Rouen.

30. *Cylapofulvius listeri*, sp. n.

Colour.—Head above dirty yellow, irrorated with red, a furcate brown marking arising from the base upwards and fading at apex of eyes, the tylus on either side with two short brown stripes; eyes grey; first segment of antennæ yellow at the base, thence becoming red and

* *Ann. Mus. Nat. Hung.* xii. p. 342 (1914).

yellow again at apex, second segment brown, white at apex and covered with short pale hairs; rostrum with the first segment reddish brown, remaining segments dirty yellow. Pronotum pale brown, darkly suffused over the calli, a triangular spot in the centre of apical margin suffused over the calli, a triangular spot in the centre of apical margin and diminishing to a median line between the calli, and the apical fifth of lateral margins narrowly red. Scutellum pale yellowish brown with two short, broad, median, basal stripes and a spot in each basal angle dark brown, apex almost white. Hemelytra with the background pale yellow, two series of fused spots down either side of clavus and three series running diagonally from base to apex of corium, fused into patches at apex, blackish brown; costal margin pale yellow with a stripe about a third of its length in the middle and fused on to corium dark brown, from the brown stripe to apex narrowly margined with pale red; cuneus entirely dark brown; membrane fuscous, veins dark brown. Underside reddish brown, except for a median longitudinal stripe pale yellow; legs pale yellow.

Structure.—Head long and narrow, slightly deflexed, with eyes scarcely broader than anterior margin of pronotum, eyes oval (seen from side), fairly large, not touching anterior margin of pronotum; tylus moderately prominent; bucculae very short; antennae inserted well in front of eyes, first segment robust, about two-thirds length of head, second segment slender, just over twice as long as first (remaining segments missing) Pronotal collar indistinct; pronotum strongly narrowed anteriorly, sides almost straight, anterior margin less than half width of posterior margin (40:90), length slightly more than width of anterior margin; calli strongly raised and reaching posteriorly over disc, giving the lateral margins a laminate appearance, posterior margin almost straight, surface rugosely granulate. Scutellum with the basal portion strongly elevated, thence suddenly deflexed to apex, the two basal ridges obliquely inclined towards the centre, sides straight. Rostrum very long, reaching to posterior margin of seventh ventrite, the first segment robust, as long as the head, remaining segments more slender. Hemelytra

finely granulate, costal margins convex at base, thence sharply narrowed to apex; embolium dilated, costal margin somewhat reflexed; cuneus indistinctly delimited; membrane extending well beyond apex of abdomen. Abdomen tumid, dull, impunctate, with a broad median impression posteriorly.

Total length 3.62 mm., width across humeral angles 1.22 mm.

Indian Ocean: Christmas Island, 1 ♂ (type), iii. 1897 (rotting wood) (*C. W. Andrews*).

This species is dedicated to J. J. Lister, who accompanied Capt. Aldrich in H.M.S. 'Egeria' as naturalist to the expedition.

From Poppius's descriptions* this species comes nearest to *grisescens*, but differs entirely in the colour-pattern, and is slightly larger, the rostrum is distinctly longer, and the length of the antennal segments do not agree.

Family Gerridæ.

31. *Limnogonus luctuosa* (Montr.).

? *Gerris luctuosa* Montrouzier, Ann. Soc. Linn. Lyon, xi. p. 242 (1864).

Limnometra lineata Carpenter, Scientific Proc. Royal Dublin Soc. (new series), vii. p. 141 (1891).

Gerris luctuosa Distant, Sarasin & Roux, 'Nova Caledonia,' Zool. i. pt. 4, no. 10, p. 384 (1914).

Limnogonus luctuosa Esaki, 'Insects of Samoa,' Aquatic Hemiptera, pt. 2, fasc. 2 (1928).

Indian Ocean: Christmas Island, 6 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—New Caledonia, Samoa.

Subfamily HALOBATINÆ.

32. *Halobates princeps* B. White.

Halobates princeps B. White, Rep. Pelagic Hemipt. ('Challenger' Rep. xix.), p. 44, pl. i. fig. 3 (1883); Kirby, Mon. Christmas Is. p. 129 (1900).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*).

Distribution.—Malayan and China Seas.

* Acta Soc. Sci. Fenn. tom. xxxvii. no. 4, p. 21 (1909).

33. *Halobates proavus* B. White.

Halobates proavus B. White, *loc. cit.* p. 54; Kirby, *loc. cit.*

Recorded from Gilolo and West Coast of Malay Peninsula.

Not taken by Dr. Harms.

Family **Naucoridæ**.34. *Heleocoris nebulosus* Mont.

var. *thienemanni* Lundb.

Heleocoris nebulosus Mont. var. *thienemanni* Lundblad, 'Archiv fur Hydrobiologie,' Suppl.-Bd. xii., "Tropische Binnengewasser, iv.," p. 72 (1933).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*).

Distribution.—Java and Sumatra.

35. *Laccocoris montandoni*, sp. n.

Suboval, somewhat flattened; head large, obtusely rounded in front, yellowish brown with a central triangular brown punctate fascia commencing at the base and graduating into two elongate lines to the apex, two short irregular punctate fasciæ on either side of the central one; two punctate black spots close to inner margins of eyes on the apical half. Eyes grey, large, subparallel on their inner margins, the outer margins forming an oblique line, the lateral process triangular and well defined, just covering anterior angle of pronotum. Pronotum a little longer than the head, yellowish brown strongly punctured with an irregular pattern, a short median broad stripe broad yellow; the anterior margin narrowly transversally striate; the lateral margins obliquely and outwardly directed to the rounded lateral angle, bright yellow with the puncturation concolorous. Scutellum brownish, finely but densely punctate, sides very slightly sinuate. Hemelytra dark brown, densely covered with fine whitish granules; clavus narrowly margined with yellow and forming a spot at the apex of the claval suture; margin of the elytra broadly rounded at embolium and thence sharply declined to membrane; embolium at the base light brown, punctate, a bright yellow spot in the middle and then fading to dark brown, exterior margin narrowly margined with bright yellow and fringed

with very short sparse brown hairs, and a small bright yellow spot at the apex of the interior margin of the embolium. Connexivum visible from above for the last three segments, whitish, fringed with minute hairs. Head beneath pale yellow, labrum triangular, yellow, rostrum with the last segment brown; antennæ pale yellow. Sternum yellowish brown. Abdomen yellow; legs yellow. the anterior femora strongly incrassate. fore and middle tibiæ with strong brown spines. posterior tibiæ and tarsi also with strong brown spines, extreme apex of hind tarsi and claws brown.

Total length 10 mm., breadth 6 mm.

Indian Ocean: Tabameer Propat F.S., 2 specimens (type and paratype). 1933 (*F. Harms*).

Closely allied to *L. nervicus* Mont., but differing chiefly in the smaller structure and less brilliant coloration, the absence of the spot at apex of scutellum, and in the dilation of the lateral margins of the pronotum, which is narrower.

This species is dedicated to Dr. A. L. Montandon in recognition of his work on this family.

HOMOPTERA.

Family Cicadidæ.

36. *Platypleura calypso* (Kirby).

Oxypleura calypso Kirby, Proc. Zool. Soc. p. 553 (1888).

Pœcilopsaltria calypso Distant, Mon. Orient. Cicad. p. 6, tab. x. fig. 3 a, b (1889).

Platypleura calypso Distant, Synonymic Cat. Homopt. pt. i., Cicadidæ, p. 7 (1906).

Indian Ocean: Christmas Island, 2 specimens, i.-iv. 1933 (*F. Harms*).

Apparently an endemic species.

37. *Dundubia rufirena* Walk.

Dundubia rufirena Walker, List Homopt. i. p. 59 (1850); Distant, Mon. Orient. Cicad. p. 40, tab. vi. fig. 6 a, b (1889).

Indian Ocean: Christmas Island (no other data), 1 specimen.

Distribution.—Malaya.

Superfamily **FULGOROIDEA.**Family **Ricanidæ.**38. *Ricania flavifrontalis* Kirby.

Ricania flavifrontalis Kirby, Mon. Christmas Is. p. 131, pl. xv. fig. 5 (1900).

Indian Ocean: Christmas Island, 12 specimens, i.-iv. 1933 (*F. Harms*); 4 specimens, 1908 (*C. W. Andrews*).
Apparently an endemic species.

39. *Varcia flavicostalis* (Kirby).

Ricania flavicostalis Kirby, Proc. Zool. Soc. p. 554 (1888).

Varcia flavicostalis Melichar, Ann. Nat. Hofmuseums, xiii. p. 319 (1899); Kirby, Mon. Christmas Is. p. 133, pl. xv. fig. 7 (1900).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*).
Apparently an endemic species.

40. *Varcia affinis* (Kirby).

Ricania affinis Kirby, Proc. Zool. Soc. p. 554 (1888).

Nogodina affinis Melichar, Ann. Nat. Hofmuseums, xiii. p. 309 (1899); Kirby, Mon. Christmas Is. p. 134, pl. xv. fig. 8 (1900).

Varcia affinis Melichar, Wytzman, Gen. Ins. Homopt. p. 163, fasc. 182 (1923).

Indian Ocean: Christmas Island, 4 specimens, i.-iv. 1933 (*F. Harms*); 1 specimen, Irving Hill, Aug. 1908 (*C. W. Andrews*).
Apparently an endemic species.

41. *Salona oceanica* Kirk.

Ricania hyalina Kirby, Proc. Zool. Soc. p. 555 (1888).

Nogodina hyalina Kirby, Mon. Christmas Is. p. 134, pl. xv. fig. 9 (1900).

Nogodina oceanica Kirkaldy, nom. nov. for *R. hyalina* Kirby, nec Germar, 'The Canadian Entomologist,' xli. p. 392 (1909).

Salona oceanica Melichar, Wytzman Gen. Ins. Homopt. fasc. 182, p. 173 (1923).

Indian Ocean: Christmas Island, 19 specimens, i.-iv. 1933 (*F. Harms*); 5 specimens, Ross Hill, 16. ix. 1908, 4 specimens, 12. ix. 1908, 1 specimen, 1908 (*C. W. Andrews*).

Apparently an endemic species.

42. *Paurostauria delicata* Kirby.

Paurostauria delicata Kirby, Mon. Christmas Is. p. 133, pl. xv. fig. 6 (1900).

Indian Ocean: Christmas Island, 1 specimen, i.-iv. 1933 (*F. Harms*); 4 specimens, 1908, 1 specimen, Murray Hill, Aug. 1908 (*C. W. Andrews*).

Apparently an endemic species.

43. *Sassula subviridis* (Kirby).

Nogodina subviridis Kirby, Mon. Christmas Is. p. 135, pl. xv. figs. 10, 11 (1900).

Sassula subviridis Distant, Ann. & Mag. Nat. Hist. iv. p. 335 (1909).

Indian Ocean: Christmas Island, 5 specimens, i.-iv. 1933 (*F. Harms*); 1 specimen, 1908 (*C. W. Andrews*).

Apparently an endemic species.

44. *Pochazia sinuata* Stål.

Pochazia sinuata Stål, Öfv. Vet.-Akad. Förh. xx. p. 160 (1865); Atkinson, Journ. Asiat. Soc. Bengal, lv. p. 54 (1886).

Indian Ocean (no exact locality), 1 specimen.

Distribution.—Java, Sumatra, Sungei, Bulu, Ben Koelen, Borneo, Malacca, Philippines.

Family Acanaloniidæ.

ANDREWSIELLA, gen. nov. (Fig. 1.)

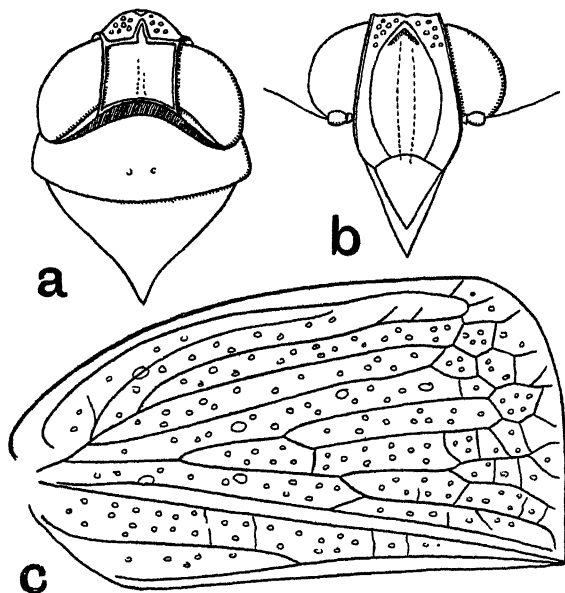
Frons produced in front of eyes; obtusely rounded; vertex a little longer than broad, strongly carinate at the anterior lateral margins and with a median anterior acuminate V-prolongation; eyes very large, reaching anterior margin of pronotum; face longer than broad, margins slightly convex, gradually widening towards clypeus, disc slightly elevated, lateral margins carinate, a median obscure percurrent ridge, and continuing throughout clypeus; clypeus almost as long as face, triangular. Pronotum narrow, arched in front between eyes, posterior margin straight, surface lightly granulate. Scutellum a little longer than pronotum. Hemelytra about twice as long as broad, costal margin convex at the basal third, thence straight to the apical angle which is rounded, apical margin straight, surface granulate particularly on the clavus, and a few scattered rounded tubercles; claval suture with a narrow coriaceous margin; wings fully developed.

Ann. & Mag. N. Hist. Ser. 10. Vol. xvii. 40

Genotype : *A. oceanica*, sp. n.

In Melichar's key * this genus approaches *Oxychara* Mel., but has a much shorter face and head, which is not conically produced, and is without the carinae on the pronotum. The hemielytra are not narrowed behind and the sutural angle is almost straight.

Fig. 1.



Andrewsiella oceanica, gen. et sp. n.

a, dorsal view of head, pronotum, and scutellum;
b, facial view of head; c, tegmen.

45. *Andrewsiella oceanica*, sp. n.

Head, pronotum, scutellum, and body greenish ochraceous, a series of whitish granules on frons at either side of the apex of vertex, base of front margined with red, shaped like an inverted V; eyes mottled grey. Legs greenish ochraceous, the tibiae narrowly margined with brown; tarsal spines and claws tipped with brown; tubercles on the tegmina yellow; wings hyaline.

Total length 6.10 mm., wing-expanse 13.7 mm.

Indian Ocean: Christmas Island, North Coast, 1 ♂ (type), Jan. 1898; 1 ♂, 1898 (*C. W. Andrews*).

* Wytsman, 'Genera Insectorum,' Homoptera, fasc. 182, p. 4 (1923).

Family **Delphacidae**.

46. *Ugyops aristella* (Kirby).

Bidis aristella Kirby, Mon. Christmas Is. p. 136, pl. xv. figs. 12, 13 (1900).

Ugyops aristella Muir, 'The Canadian Entomologist,' p. 264, Aug. 1915.

Indian Ocean: Christmas Island, 7 specimens, i.-iv. 1933 (*F. Harms*); Irving Hill, 1 specimen, Aug. 1908 (*C. W. Andrews*).

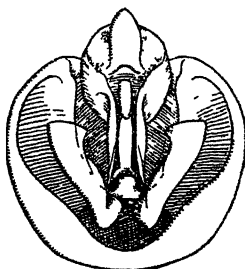
Apparently an endemic species.

47. *Delphacodes muirianus*, sp. n. (Fig. 2.)

Male.—Macropterous; length 1.5 mm., tegmen 2 mm.

Vertex slightly longer than wide, apex slightly rounded, projecting a little beyond eyes, base at about middle of

Fig. 2.



Delphacodes muirianus, sp. n.

Apical view of ♂ pygophor.

eyes; length of frons more than double the width; median carina simple; antennæ reaching beyond base of clypeus, first segment longer than wide, second segment about one and a half times length of first. Tegmina passing apex of abdomen. Opening of pygophor wider than long; margins entire; anal emargination large, anal angles simple; diaphragm very short in middle between bases of genital styles in tongue-shaped lobe; anal tube with two spines exceptionally long and slender, extending to behind base of genital styles; genital styles widened apically and truncate, inner margins concave, outer margins convex. *Ædeagus* subtubular, apical third curved ventrally at right angles, several small spines around the apical third.

Colour.—Dark brown between carinæ of face and clypeus, carinæ of face and thorax lighter than ground-colour. Abdomen fuscous. Tegmina hyaline, veins same colour as membrane, granules minute, same colour as veins.

Genitalia figured.

Female.—Brachypterous; length 1.9 mm., tegmen 1.1 mm., reaching to base of fifth abdominal tergite, similar in colour to male, femora and tibiæ darkish brown, becoming lighter laterally; tarsi yellowish.

Described from 1 ♂, Indian Ocean; Christmas Island, 1. iv. 1933 (*F. Harms*); 20 ♀♀, 1. iv. 1933, 1 ♀, Shore Terrace, 1. ii. 1933 (*F. Harms*).

Respectfully dedicated to the late Dr. F. Muir in recognition of his work on the family.

Family Issidæ.

48. *Moniana andrewsi* (Kirby).

Issus (?) *andrewsi* Kirby, Mon. Christmas Is. p. 138, pl. xv. fig. 15 (1900).

Moniana andrewsi Distant, Ann. & Mag. Nat. Hist. iv. p. 76 (1909).

Indian Ocean; Christmas Island, 1 specimen, i–iv. 1933 (*F. Harms*).

Apparently an endemic species.

Family Tropiduchidæ.

49. *Kallitaxila granulata* (Stål).

Taxila granulata Stål, Öfv. Vet.-Ak. Förh. xxvii. p. 750 (1870).

Kallitaxila Kirkaldy, 'The Entomologist,' xxxiv. p. 6 (1901), nom. nov. for *Taxila* Stål (nec Doubleday, 1847, Lepidopt.).

Taxilana Melichar, Verhandl. des Naturforsch. Vereines in Brünn. liii. p. 90 (1914), nom. nov. for *Taxila* Stål (nec Doubleday, 1847).

Indian Ocean: Christmas Island, 1 specimen, i–iv. 1933 (*F. Harms*).

Distribution.—Indo-Malayan region.

Family Cercopidæ.

50. *Clovioa eximia* Kirby.

Clovioa eximia Kirby, Mon. Christmas Is. p. 137, pl. xv. fig. 14 (1900).

Indian Ocean: Christmas Island, 22 specimens, i–iv. 1933 (*F. Harms*); 1 specimen, Flying Fish Cove, Sept. 1908 (*C. W. Andrews*).

Family Jassidæ.

51. *Bythoscopus punctatus* (Kirby).

Idiocerus (?) *punctatus* Kirby, Mon. Christmas Is. p. 138, pl. xv. fig. 16 (1900).

Bythoscopus punctatus Distant (inedit).

Indian Ocean: Christmas Island, 10 specimens, i.-iv. 1933 (*F. Harms*).

Apparently an endemic species.

52. *Drabescus conspicuus* Dist.

Drabescus conspicuus Distant, Faun. Brit. India, Rhyn. iv. p. 306 (1908).

Indian Ocean: Christmas Island, 15 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—Ceylon.

53. *Deltocephalus infirmus* Mel.

Deltocephalus infirmus Melichar, Hom. Faun. Ceylon, p. 203, t. v. fig. 11 (1903).

Deltocephalus infirmus Distant, Faun. Brit. India, Rhyn. iv. p. 386 (1908).

Indian Ocean: Christmas Island, i -iv. 1933, 3 specimens (*F. Harms*).

Distribution.—India, Ceylon.

54. *Athysanus indicus* Dist.

Athysanus indicus Distant, Faun. Brit. India, Rhyn. iv. p. 344 (1908).

Indian Ocean: Christmas Island, 8 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—India.

55. *Nesosteles sanguinescens* Kirk.

Nesosteles sanguinescens Kirkaldy, Report of Work of Exp. Stn. Hawaiian Sugar Plant. Assoc., Leaf-Hoppers, Bull. i. pt. 9, p. 344 (1906).

Indian Ocean: Christmas Island, 39 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—Fiji Is., Queensland, Brisbane.

56. *Balclutha montana* Mel.

Balclutha montana Melichar, 'Notes from the Leyden Museum,' xxxvi. p. 138 (1914).

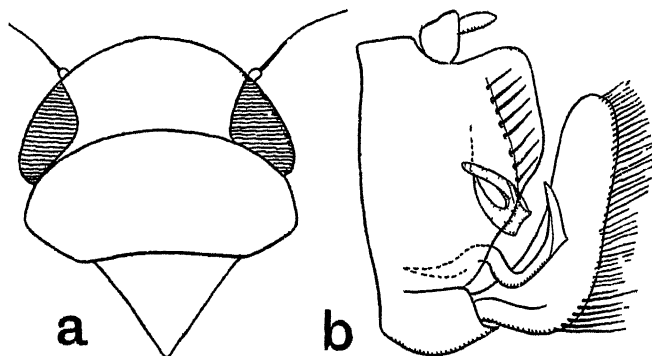
Indian Ocean: Christmas Island, 2 specimens, i.-iv. 1933 (*F. Harms*).

Distribution.—Java.

57. *Xestocephalus minutus*, sp. n. (Fig. 3.)

Pale yellow. Head pale brown, immaculate, slightly narrower than pronotum, broadly rounded apically; vertex about half as long as wide between eyes; frons pale brown; antennæ yellow; clypeus about as broad as long, sides parallel, apex truncate. Scutellum with two circular brown spots at the base. Tegmina with two large and two small spots on the clavus, a large semicircular blotch on the corium widening apically, two large spots at the apex of the clavus, and two small

Fig. 3.

*Xestocephalus minutus*, sp. n.

a, dorsal view of head, pronotum, and scutellum;
b, lateral view of ♂ genitalia.

ones towards apex of costal margin brown. Dorsal side of abdomen fuscous, ventral side and legs whitish yellow.

♂ genitalia figured.

Total length 2.25 mm.

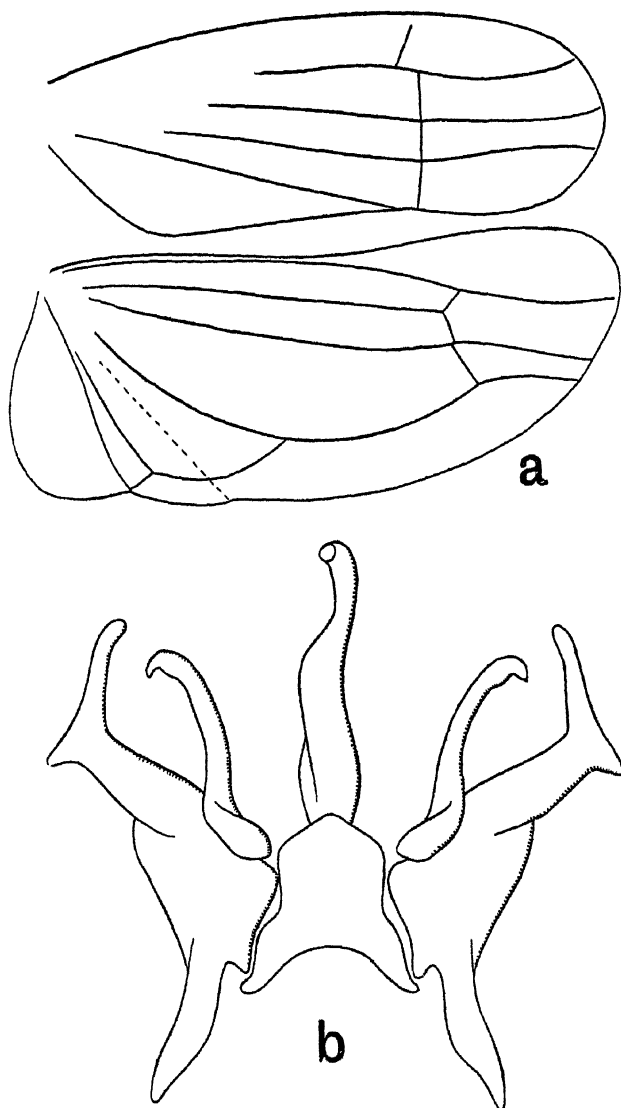
Indian Ocean: Christmas Island, 3 specimens, including ♂ type, i.-iv. 1933 (*F. Harms*).

3 specimens, North Coast, xii. 1897; 1 specimen, East Coast, viii. 1897 (*C. W. Andrews*).

Runs down in Melichar's key* to *apicalis* Mel., but very much smaller. Resembles *X. minimus* China in small size, but differs in broadly rounded head and in shape of posterior lateral margin of pygophorus.

* 'Notes from the Leyden Museum,' xxxvi. p. 139 (1914).

Fig. 4.



Erythroneura harmsi, sp. n.

a, tegmen and wing ; *b*, internal ♂ genitalia.

58. *Erythroneura harmsi*, sp. n. (Fig. 4, p. 599.)

Colour.—Head flavescent; eyes brownish, becoming darker at their inner angles. Pronotum flavescent; scutellum brownish; meso- and metapleura uniformly stramineous. Tegmina semi-hyaline whitish, veins slightly darker; wings hyaline with a bluish tinge, veins whitish. Legs pale yellow, extreme apices of tarsi brown; abdomen pale yellow.

Structure.—Ocelli absent, head slightly narrower than pronotum across humeral angles, a little longer in middle than length at eyes and somewhat less than width between eyes; face longer than wide, the frons more than three times longer than clypeus. Scutellum triangular with a median transverse sulcation. Tegmina extending beyond apex of abdomen, venation normal; last ventrite (♀) posteriorly truncate; male genital claspers and aedeagus figured.

Total length 2.37 mm.; width across humeral angles 0.5 mm.

Indian Ocean: Christmas Island, numerous specimens, i.-iv. 1933 (*F. Harms*); and Shore Terrace, 1933 (*F. Harms*).

This species is dedicated to the collector in recognition of his work on the Christmas Island fauna.

LXII.—*New and little-known African Bees of the Subfamily Anthidiinæ (Apoidea)*.—Part II. By G. A. MAVROMOUSTAKIS, Limassol, Cyprus.

THE types of the new species described in this part are placed in the British Museum.

Pachyanthidium truncatum (Smith).

The British Museum has the following series:—NIGERIA: Nr. Lagos, 8 ♀♀, i. 1920 (*W. P. Lowe*); ASHANTI: Obuasi, 1 ♀, 1908 (*W. M. Graham*). I have in my collection the following specimens, received from the American Museum:—CONGO: Stanleyville, 1 ♂, iii. 1915; 1 ♂, 4. vii. 1915; 1 ♀, iv. 1915 (*Lang & Chapin*), and determined by H. F. Schwarz.

Smith described *Pachyanthidium truncatum* from the female, and Friese has later described the male, stating

that the sixth and seventh tergites are black. Friese's male is undoubtedly a different species. The Ashanti, Nigeria, and Congo females are alike; length 6-6.5 mm.; fifth tergite with the apical margin light reddish brown, lateral yellow marks nearly reaching middle; sixth tergite entirely yellow or with an obscure central spot. The males have the clypeus and the lateral face-marks cream; sixth and seventh tergites entirely yellow; length 5.5 mm.

Pachyanthidium truncatum alberti Ckll.

NYASALAND: Mlanje, 2300 ft., 1 ♀, 8. x. 13 (*S. A. Neave*); UGANDA: Kampala, 2 ♀♀, 2 ♂♂, 12-20. iii. 1918; 1 ♂, 6. x. 1915 (*C. C. Gowdey*).

The above females agree with the original description, and they are larger than the specimens from West Africa and Stanleyville. The males have the clypeus and lateral face-marks cream; sixth tergite longitudinally black in the middle and yellow at sides or basal half longitudinally black in the middle; seventh tergite yellow.

Hypanthidium silverlocki, sp. n.

Male.—Length 7 mm.

Black; clypeus, supraclypeal area, lateral face-marks (filling space between clypeus and supraclypeal area and eyes) a little surpassing level insertion of antennæ and then narrowing along inner orbits to the top, all pale yellow; mandibles pale yellow, apex black-brown; occiput with entire stripe, broadly descending on cheeks and nearly reaching base of mandibles, light lemon-yellow; scape black with a yellow stripe beneath; first and second joints of flagellum black-brown, otherwise flagellum brown beneath and dark brown above; clypeus shining and punctured, with a somewhat broad and median longitudinal impunctate space nearly reaching lower margin; vertex and occiput densely punctured and moderately shining; clypeus, sides of face with shining white hairs; front with dense greyish-white hairs; cheeks with short white hairs. Thorax dull, finely and very densely punctured; mesonotum on each side above with short yellowish stripe; scutellum somewhat projected, rounded and slightly emarginate

in middle; apical margin of scutellum and axillæ broadly yellowish, between axillæ and scutellum without emargination; tubercles yellow; tegulæ brownish, broadly pale yellow in front and with small yellowish-brown mark behind; thorax with short yellowish hairs above and with dense and somewhat long white hairs at sides; wings nearly clear, apical margin and a transverse streak on marginal cell very slightly clouded; second recurrent nervure out of second transverse cubital nervure; anterior femora light reddish brown, with a very light lemon-yellow stripe beneath; middle femora light reddish brown, with a very light lemon-yellow stripe beneath not reaching base; hind femora light reddish brown, with a short apical light lemon-yellow stripe beneath; femora with apex narrowly light lemon-yellow above; tibiæ very light lemon-yellow above; anterior tibiæ with a short black-brown stripe beneath, middle and hind ones black-brown beneath; tarsi very light lemon-yellow, small joints light reddish brown; legs with shining white hairs; hind basitarsi densely covered with yellowish-brown hairs on inner side; pulvilli absent; spurs yellow. Abdomen black and shining, finely and densely punctured; tergites 1 to 3 with a transverse median and somewhat broad light lemon-yellow stripe; fourth tergite with a transverse pale yellow stripe; below the yellow on third and fourth tergites light reddish brown at sides; tergites 5 to 7 pale yellow; fifth and sixth tergites with a basal and transverse very narrow light reddish-brown stripe, apical margin of fifth black-brown in middle and light reddish brown at sides; apical margins of tergites finely and densely punctured; fifth tergite with a small lateral tooth; apical margin of sixth tergite normal and reddish brown, but a little above transversely irregularly subcrenulate and resulting in a long lateral tooth; seventh tergite somewhat flat and with three apical small emarginations, but a little above apical margin with a row of very small irregular spines, the middle one of which somewhat protruding in the median emargination; ventral segments light reddish brown; sixth ventral segment flat, with rounded apical margin.

NORTHERN RHODESIA: 30 miles W. of Kariba Gorge, 1 ♂ (type), 25. vi. 10 (*Silverlock*).

Related to *Hypanthidium malacopygum* (Gribodo) from Algeria, but the last species has the sides of fifth tergite unarmed, the apical margin of the flat sixth ventral segment truncate, and the structure of seventh tergite and the tegumental colour of the body different. *Hypanthidium silverlocki*, sp. n., has the maxillary palpi 2-jointed, second joint very small.

Anthidiellum swalei, sp. n.

Female.—Length nearly 6 mm.

Black; clypeus pale lemon-yellow, punctured and shining, somewhat broader than long, lower margin without tubercles; mandibles 4-dentate, basal half yellowish, rest reddish brown except the black-brown teeth; scape black, flagellum dark brown, but darker above; lateral face-marks (filling space between clypeus and supraclypeal area and eyes) reaching level insertion of antennæ, supraclypeal area except the middle upper part, all pale lemon-yellow; a very short yellow stripe above each eye; vertex and occiput strongly punctured and shining; a small polished and smooth space laterally of each lateral ocellus; front, sides of face, clypeus, and cheeks with sparse and very short shining white hairs; vertex and occiput with some very sparse and short whitish hairs. Thorax black; mesonotum shining, very strongly and densely punctured; a short yellow stripe on each side of mesonotum; scutellum projected, sharply edged, rounded at sides and slightly emarginate in middle; axillæ with a yellow mark; apical margin of scutellum narrowly brown, but a little above with a yellow stripe broadly interrupted in middle; tegulæ finely punctured and brown, subhyaline in front and narrowly pale behind; tubercles rounded, yellowish brown, and slightly erected in front; wings nearly clear; second recurrent nervure out of second transverse cubital nervure; thorax with some very sparse and short white hairs above and with shining white hairs at sides; femora yellowish brown, anterior and middle ones with a narrow and brown stripe beneath; anterior and middle tibiæ yellowish brown, with basal yellowish mark and a short brown stripe above; hind tibiæ yellowish brown beneath and yellow above except the broadly brown middle;

tarsi yellowish brown; hind basitarsi yellow, flat, broad and short, and densely covered with short golden hairs on inner side; spurs yellow; pulvilli present. Abdomen black and shining; first and second tergites somewhat finely punctured, third and following tergites with shallow and broader punctures; first and second tergites with lateral yellow mark; third tergite with long lateral yellow stripe; apical margins of tergites 1 to 3 narrow, polished and black except the yellowish-brown sides; fourth tergite with a transverse yellow stripe interrupted in middle, apical margin broadly yellowish brown; fifth and sixth tergites deep yellow; ventral segments yellowish brown; ventral scopa very light golden white.

Male.—Length nearly 6 mm.

Similar to the female; all face below antennæ light lemon-yellow; scape black, base and apex yellowish brown; flagellum brown; third antennal joint yellowish brown; the lateral yellow stripe on mesonotum and the yellow spot on axillæ lacking; tergites 4 to 7 yellow; the yellow on fourth tergite medianly interrupted by black; fourth and fifth tergites with transverse and linear black-brown stripe above apical margin; fourth tergite with basal and lateral black mark; sixth tergite entire; seventh tergite entire, with a very short longitudinal carina reaching middle of apical margin; ventral segments yellowish brown; second ventral segment with a minute tubercle near middle of apical margin; apical margin of third ventral segment with a small and pointed tubercle in middle; apical margin of fifth ventral segment black, very finely serrate and emarginate.

SOUTHERN RHODESIA: Lonely Mine, 1 ♀ (type), 26. xii. 14 (*A. Swale*), and 1 ♂ (allotype), 26. v. 13 (*H. Swale*); Matopos, 1 ♀ (paratype), 18. ii. 1923 (in Rhodesian Museum), agrees with the type, but the supraclypeal area black and pale lemon-yellow at sides; base of scape yellowish brown beneath; the yellow on axillæ and at sides of mesonotum lacking; Sawmills, 1 ♀ (paratype), 25. xii. 1925 (in Rhodesian Museum), has on each side between antennæ a small longitudinal yellow stripe reaching upper part of supraclypeal area; Khami, 1 ♀ (paratype), 28. x. 1928 (in Rhodesian Museum), has the yellow spot on axillæ and the yellow stripe at sides of mesonotum.

Anthidiellum swalei, sp. n., is closely related to *Anthidiellum zebra* (Frieese), but latter has the tegumental colour different, the punctation of abdomen more sparse, and the vertex, occiput, and mesonotum dullish.

Anthidiellum flavescens (Frieese).

Through the kindness of Dr. G. Arnold, Director of the Rhodesian Museum, I received a male taken at Bulawayo, 21. xii. 1919, and determined by Frieese as *Anthidium minutulum flavescens* Frieese. The above specimen, on which Frieese probably based his variety (Zool. Jahrb. xlix. Abt., f. Syst. p. 509), has well-developed pulvilli, projected scutellum, slightly erected tubercles, venation of *Dianthidium*, and it is therefore a member of *Anthidiellum*. Frieese, in his description of *Anthidium minutulum flavescens*, says that "seventh tergite terminates in a little hump," but besides this the above example has the apical margin of sixth tergite somewhat bluntly pointed in the middle. *Anthidium minutulum* is described by Brauns as having the seventh tergite with an impression and emargination. According to a sketch drawn for me by Mr. G. van Son the typical male of *Anthidium minutulum* (in Transvaal Museum) has the apical margin of sixth tergite unarmed and that of seventh with three emarginations, the middle one of which is deeper than the others. Besides this I have been informed by Mr. van Son that the typical male has no pulvilli and its venation is like that of *Dianthidium*. I have examined two females of *Anthidium minutulum* from Willowmore determined by Brauns, and they have no pulvilli and belong to a group related to *Hypanthidium*. The variety *flavescens*, described by Frieese as belonging to *Anthidium minutulum* Brauns, is a distinct species which may be named *Anthidiellum flavescens* (Frieese). Mr. A. J. Hesse, of the South African Museum, has kindly loaned to me 2 ♀♀ and 1 ♂ of *Anthidiellum hessei* Ckll., from S.W. AFRICA: Kaoko Otavi. Mr. Hesse wrote me as follows:—"We are not in possession of the types of *Anthidiellum hessei*, but Cockerell based his description on a pair from this material which I myself handed over to him." By a close comparison of the male *Anthidiellum flavescens* from Bulawayo with the male of *Anthidiellum hessei* from Kaoko Otavi I am unable

to separate both specimens, as they are identical. The female of *Anthidiellum flavescens* is similar to the male. Mandibles very briefly 4-dentate; apical half of mandibles black-brown; lower margin of clypeus with four very small rounded tubercles; scape and second antennal joint black; ventral scopa light golden white.

The British Museum has a series of females of *Anthidiellum flavescens* from S. RHODESIA: Lonely Mine (*A. Swale*), and the Transvaal Museum has 2 ♀♀ and 1 ♂ from Bulawayo (*R. H. R. Stevenson*).

LXIII.—*The Nematode Genus Rondonia Travassos.* By
H. A. BAYLIS, M.A., D.Sc., Department of Zoology,
British Museum (Natural History).

THE genus *Rondonia* was very briefly defined by Travassos (1920), and the species *rondoni* indicated as its type. This species was said to be a parasite of Brazilian river-fishes, but these were not mentioned by name. In a later paper (1923) Travassos refers to the occurrence of *R. rondoni* in *Piaractus brachypomus*, but the species appears to have been described and figured for the first time by Travassos, Artigas, and Pereira (1928), who recorded as its hosts *Piaractus brachypomus*, *Myletes torquatus*, *Doras granulatus* and *Myleus* sp.

The writer has recently had occasion to examine some Nematodes from another fish (*Doras* [*Pseudodoras*] *brunnescens*), collected by Dr. W. N. F. Woodland during his expedition to the Amazon in 1931. These were found to agree on the whole with the description of *R. rondoni*, but differed from it in certain small points. The material was also compared with specimens from *Piaractus brachypomus*, identified as *R. rondoni* by Dr. Herman Lent and Dr. Teixeira de Freitas, of the Instituto Oswaldo Cruz, Rio de Janeiro. In these again the same differences from the description were found. There appears to be no reason to doubt that both sets of specimens belong to Travassos' species, but some slight redescription seems desirable.

The males measure about 5–6.25 mm. in length, the females about 6–7.9 mm. The maximum thickness is about 0.3 mm. in the male and a little more in the

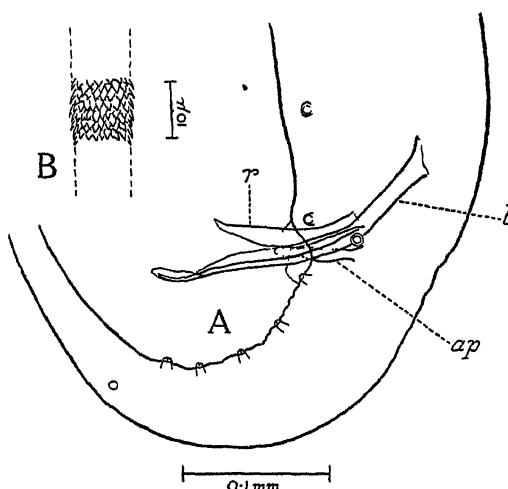
female. The three bilobed lips, each of which has two rather prominent papillæ, measure about 0.02 mm. (not 0.2 mm.) in length. The total length of the œsophagus, measured from the anterior extremity, is about 0.74–0.83 mm. in the male and 0.77–0.95 mm. in the female. Its stout, cylindrical, anterior portion (the œsophagus proper) measures 0.43–0.55 mm. in length. Its lining is strengthened by three cuticular rods. The posterior portion, which is in reality a bulb with a long, narrow “neck,” is 0.28–0.4 mm. long. The swollen hinder part of the bulb has a diameter of about 0.14 mm. The three so-called “valves” in its interior take the form of rounded pads covered with finely ribbed cuticle, and may perhaps serve as a grinding apparatus. The nerve-ring is situated near the anterior end of the neck of the bulb, and the excretory pore at a variable distance (about 0.1–0.2 mm.) behind the junction of the bulb with the intestine.

The caudal end of the male is curled ventrally, usually forming a full turn of a spiral. The tail is tapering and pointed, and measures about 0.55–0.7 mm. in length. Travassos, Artigas and Pereira state that there are four equidistant pairs of postanal papillæ and one pair of preanal. In the present material (from both the sources referred to above) nine pairs of papillæ have been observed (fig. 1, A). Of these five are postanal (the most posterior being laterally or subdorsally situated, the others subventrally), two adanal (one subventral, at or immediately behind the angles of the cloacal aperture, and one lateral), and two preanal and subventral. The spicules are unequal in length and dissimilar in form. The left spicule is 0.18–0.225 mm. long, and is provided with delicate alæ for about the distal two-thirds of its length. The spicule shows a slight torsion about its axis near the tip. The right spicule is about half as long as the left (0.1–0.12 mm.) and is simple, somewhat swollen in the middle, and sharply pointed at the tip. The accessory piece is about 0.045–0.07 mm. (not 0.64 mm.) long, and is of a tubular structure.

Travassos, Artigas and Pereira mention the presence, in front of the cloacal aperture, of two parallel linear “chitinous formations” composed of small apposed rectangles. The writer’s interpretation of these struc-

tures is somewhat different. They appear to be continuous longitudinal strips or very slightly raised ridges of cuticle, 0.01–0.014 mm. wide, closely set with minute, backwardly-pointed spines*. These spines are arranged in transverse rows of about 8–10 (fig. 1, B). The "strips," which appear to be easily detached from the underlying cuticle, run along the subventral surfaces of the body, beginning at about 0.3 mm. in front of the cloacal aperture and extending forward for a distance of about 1 mm. When the cuticle of the ventral surface

Fig. 1.

*Rondonia rondoni* Trav.

A, cloacal region of male; lateral view. *a.p.*, accessory piece; *l.*, left spicule; *r.*, right spicule. B, surface-view of a small portion of one of the spiny ridges.

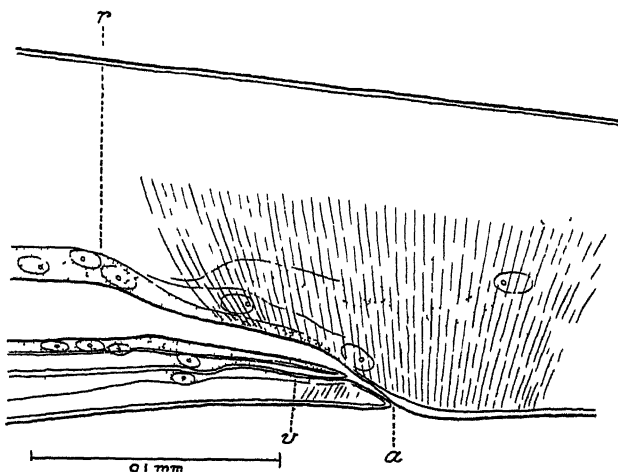
is thrown into pronounced transverse folds or wrinkles, these spiny areas sometimes have the appearance of being divided transversely into a series of small cushion-like pads.

The genital tube is single, and ends anteriorly in a single, reflexed testis, which extends somewhat in front of the middle of the body.

* Similar structures occur in *Atractis dactyluris* (Rud.) and other species of *Atractis*.

The tail of the female is, like that of the male, tapering and pointed, but is straight. It measures 0.75–1.33 mm. in length in the specimens seen by the writer (0.67 mm., according to Travassos, Artigas and Pereira). In this genus the female has a character which is very exceptional among Nematodes, in that the reproductive system has a common opening with the alimentary canal. As in the male, the genital tube is single. It lies, for the greater part of its length, on the left side of the intestine, but passes, as a non-muscular vagina, ventrally to the rectum to open by a very narrow aperture just within

Fig. 2.



Rondonia rondoni Trav. Anal region of female; lateral view.

a., ano-genital aperture; r., rectum; v., vagina.

the anus (fig. 2). The single, reflexed ovary does not, in young females, extend as far as the middle of the body. In gravid females, however, it appears to be pushed further forward by the development of the uterus. The worm is viviparous, producing a relatively small number of larvæ at a time. These escape from their thin vitelline membranes and attain a length of about 2–2.2 mm. in the uterus. The oesophagus of the larva, while still within the egg-membrane, is already of the same form as in the adult. In the hatched larva it attains a length of 0.4–0.44 mm. According to Travassos,

Artigas and Pereira the number of larvæ present at a time in the uterus rarely exceeds two, and they state that the larvæ are apparently liberated by the rupture of the body of the female. Gravid females were scarce in the material examined by the writer, and evidence of this method of birth was not observed. One female, however, contained no less than nine free larvæ, and these, as was proved by dissection, all lay within the uterus, the wall of which was intact.

From the description just given it will be seen that *Rondonia* is, in almost all respects, a typical member of the family Atractidæ. The only feature, in fact, which appears to distinguish it from the genus *Atractis* is the presence of a common ano-genital aperture in the female, and this condition would be reached by a very slight modification of that seen in *Atractis* and the other genera of the family, in all of which the vulva is close to the anus. It seems open to question, therefore, whether this character is of generic importance.

The writer is indebted to the Director of the Wellcome Research Institution for the opportunity of studying Dr. Woodland's specimens.

REFERENCES.

- TRAVASSOS, L. 1920. "Esboço de uma Chave geral dos Nematodes parasitos." Rev. Vet. e Zootech., Rio de Janeiro, pp. 59-70 bis, 1 table.
 —. 1923. "Informações sobre a Fauna Helminthologica do Matto Grosso." Folha Medica, Rio de Janeiro, iv. p. 29.
 —, ARTIGAS, P., & PEREIRA, C. 1928. "Fauna Helminthologica dos Peixes de Agua Doce do Brasil." Arch. Inst. Biol., São Paulo, i. pp. 5-68, pls. i.-xiv.

LXIV.—On some Collembola from Lapland.

By JAMES MEIKLE BROWN, B.Sc., F.L.S., F.R.E.S.

I AM indebted to Mr. D. V. Fitzgerald, F.R.E.S., for placing at my disposal for determination a small but interesting collection of Collembola made by him in the Islands of Seiland and Kvaloën, in Finmark, during June and July 1934.

The material, preserved in alcohol, was contained in eight tubes bearing the following data :—

No. 2897. Seiland, vi. 34. Among cushions of Moss and Mossy-Campion, on barren summit, 3200 feet. (This was the richest gathering and contained nine species.)

No. 2898. Seiland, vi. 34. In Moss and Lichen cushions, on ledge near the top of mountain, 3000 feet. (This contained four species.)

No. 2924. Seiland, vi. 34. Among tufts of Mossy-Campion, on exposed summit, 1600 feet. (This included five species.)

No. 2958. Seiland, vi. 34. Among cushions of Moss, on exposed rock-surface, at 2600 feet. (This contained four species.)

No. 2973. Seiland, vi. 34. Surface of snow, 2600 feet. (This contained one species.)

No. 2815. Kvaloën, vi. 34. From *Empetrum*-*Betula nana* association, on exposed ridge, 100 feet. (This included five species.)

No. 2819. Kvaloën, vi. 34. Seaweed belt beyond tide-mark. (Included three speceis.)

No. 3009. Kvaloën, vii. 34. Surface of standing water. (Contained one species.)

Sixteen species and varieties of *Collembola* were represented among the approximately two hundred specimens.

LIST OF SPECIES COLLECTED.

Order COLLEMBOLA Lubb.

Suborder ARTHROPLEONA Börn.

Family Hypogastruridæ Börn.

1. *Hypogastrura armata* (Nic.).

- 1841. *Podura armata* Nicolet, Nouv. Mém. Soc. Helv. Sci. Nat. p. 57.
- 1871. *Achorutes armatus* Tullberg, Öfv. Kongl. Vet.-Akad. Förhandl. p. 153.
- 1904. *Achorutes armatus* Ågren, Arkiv f. Zool. p. 2.
- 1912. *Hypogastrura armata* Linnaniemi, Acta Soc. Sc. Fenn. p. 13.
- 1931. *Hypogastrura armata* Brown, Ann. & Mag. Nat. Hist. p. 132.

This is a widely distributed species, extending from the Arctic Regions southward to New Zealand. It is

represented in the samples 2924 (one specimen) and 2897 (six specimens), occurring mainly in such material as moss.

2. *Xenylla humicola* (Fabr.).

1876. *Xenylla humicola* Tullberg, Öfv. K. Sv. Vet.-Akad. Forhandl. p. 39.

1912. *Xenylla humicola* Linnaniemi, Acta Soc. Sc. Fenn. p. 42.

This species seems to be confined in its distribution to the Northern Hemisphere. It commonly occurs in moss, in soil, and under bark, and at the sea margin. In the present collection it occurred once only, in 2819, as several specimens, under seaweed. It was not recorded for Lapland either by Ågren (1904) or by Brown (1931).

3. *Friesea mirabilis* (Tullb.).

1871. *Friesea mirabilis* Tullberg, Öfv. K. Vet.-Akad. Forhandl. p. 155.

1912. *Friesea mirabilis* Linnaniemi, Acta Soc. Sc. Fenn. p. 57.

This is another Northern species, found most frequently under bark or in moss and humus. Like the last species it does not occur in the lists for Lapland given either by Ågren or Brown. In the present collection it occurs in samples 2897 (one individual), 2815 (one individual), and 2898 (one individual). It appears therefore to be not very plentiful and to favour mossy tufts.

Family Onychiuridæ Börn.

4. *Onychiurus armatus* (Tullb.) var. *arcticus* (Tullb.).

1876. *Lipura arctica* Tullberg, Öfv. K. Sv. Vet.-Akad. Forhandl. p. 39.

1904. *Onychiurus armatus* var. *arcticus* Ågren, Arkiv f. Zool. p. 12.

1912. *Onychiurus armatus* var. *arcticus* Linnaniemi, Acta Soc. Sc. Fenn. p. 87.

1922. *Onychiurus armatus* var. *arcticus* Carpenter & Phillips, Proc. Roy. Irish Acad. p. 13.

Onychiurus armatus is a widely distributed species occurring in most parts of the world. The specimens in the present collection agree with the var. *arcticus* in having the bristle of the empodial appendage extending beyond the apex of the claw, but they are not of exceptionally large size. The foot-claws also bear an internal tooth (as in the var. *denticulata* Handsch.). *O. armatus* var. *arcticus* occurs commonly in Arctic and sub-Arctic regions

of Europe, such as N. Scandinavia, N. Russia, Novaya Zemlya, Spitzbergen and Bear Island, and also in Siberia.

It was fairly plentiful in two samples, 2815 (nine specimens) and 2924 (eight specimens).

Family Isotomidae Börn.

5. *Tetracanthella wahlgreni* Axels (Linnan.).

1907. *Tetracanthella wahlgreni* Axelson (Linnaniemi) Acta Soc. Sc. Fenn. p. 129.

1912. *Tetracanthella wahlgreni* Linnaniemi, Acta Soc. Sc. Fenn. p. 103.

1931. *Tetracanthella wahlgreni* Brown, Ann. & Mag. Nat. Hist. p. 133.

This species is found mainly in moss or beneath stones, and appears to be confined to Arctic or sub-Arctic regions. It has been taken in Norway, Sweden, Bear Island, and Spitzbergen, and has been reported from Lapland previously (Brown, 1931). In this collection it occurs in samples 2897 (several individuals) and 2958 (one specimen).

6. *Folsomia quadrioculata* (Tullb.).

1871. *Isotoma quadrioculata* Tullberg, Öfv. K. Vet.-Akad. Förhandl. p. 152.

1904. *Isotoma quadrioculata* Ågren, Arkiv f. Zool. p. 21.

1912. *Folsomia quadrioculata* Linnaniemi, Acta Soc. Sc. Fenn. p. 111.

1931. *Folsomia quadrioculata* Brown, Ann. & Mag. Nat. Hist. p. 133.

1932. *Folsomia quadrioculata* Brown, Ann. & Mag. Nat. Hist. p. 332.

A small inconspicuous species, but widely distributed in the Northern Hemisphere, and most often occurring in large numbers in moss and humus, or under bark. In the present collection it is represented in five samples, 2898 (numerous specimens), 2815 (several specimens), 2958 (one individual), 2924 (numerous specimens), and 2897 (numerous specimens).

7. *Pseudisotoma sensibilis* (Tullb.)

1876. *Isotoma sensibilis* Tullberg, Öfv. K. Sv. Vet.-Akad. Förhandl. p. 36.

1904. *Isotoma sensibilis* Ågren, Arkiv f. Zool. p. 17.

1912. *Isotoma (Vertagopus) sensibilis* Linnaniemi, Acta Soc. Sc. Fenn. p. 143.

1924. *Pseudisotoma sensibilis* Handschin, Mém. Soc. helv. Sci. nat. p. 111.

1932. *Pseudisotoma sensibilis* Brown, Ann. & Mag. Nat. Hist. p. 333.

This species is widely distributed throughout Europe, and has been taken in North America and Novaya

Zemlya. It is found chiefly in moss and humus. It is represented in the present collection in sample 2958 (two specimens).

8. *Isotoma viridis* (Bourl.).

1839. *Isotoma viridis* Bourlet, Mém. Soc. des Sc. de l'Agricult. de Lille, p. 401.

1904. *Isotoma viridis* Åron, Arkiv f. Zool. p. 17.

1931. *Isotoma viridis* Brown, Ann. & Mag. Nat. Hist. p. 136.

This is a species of world-wide distribution, and one of the commonest of Collembola. It occurred under the f. *principalis* in six samples in the present collection, viz. 2898 (numerous specimens), 2815 (several specimens), 2819 (numerous specimens), 2958 (two specimens), 2924 (numerous specimens), and 2897 (numerous specimens). As might have been expected, it was the most numerous species in the collection, occurring in a variety of situations.

9. *Isotoma olivacea* Tullb.

1871. *Isotoma olivacea* Tullberg, Öfv. Sv. Vet.-Akad. Forhandl. p. 151.

1912. *Isotoma olivacea* Linnaniemi, Acta Soc. Sc. Fenn. p. 149.

The f. *principalis* does not appear to be so common in most parts as the var. *griseus* (Schäff.), but was present in two samples in the collection, 2897 (several individuals) and 2989 (several individuals). The var. *griseus* was reported from Finland by Brown (1931), the Oxford University Expedition bringing back two specimens.

10. *Isotoma bipunctata* Axels.

1903. *Isotoma bipunctata* Axelson, Acta Soc. pr. F. et Fl. Fenn. p. 9.

1912. *Isotoma bipunctata* Linnaniemi (Axelson), Acta Soc. Sc. Fenn. p. 170.

This interesting species, which has been found in Norway, Finland, and Russia, was represented by a single individual in sample 2897 at an altitude of 3200 feet.

Family Entomobryidæ Börn.

11. *Isotomurus palustris* (Müll.).

1872. *Isotoma palustris* Tullberg, K. Sv. Vet.-Akad. Handl. p. 45.

1912. *Isotomurus palustris* Linnaniemi, Acta Soc. Sc. Fenn. p. 186.

This very widely distributed species was represented in a single sample, 2973, by numerous specimens, all of the

f. *prasina* Reut., which frequently is found, as in the present instance, to occur abundantly on the surface of snow.

12. *Entomobrya nivalis* (Linn.) f. *maculata* Schöff.

1904. *Entomobrya nivalis* ab. *maculata* Ågren, Arkiv f. Zool. p. 22.

1912. *Entomobrya nivalis* var. *maculata* Linnaniemi, Acta Soc. Sc. Fenn. p. 207.

This variety of the very common species *E. nivalis* seems to be the form described by Lubbock as *Degeeria nicoletii* (Lubbock, 1867, p. 299). It is present very sparingly in two of the samples, 2819 (two individuals) and 2815 (one individual).

13. *Lepidocyrtus lanuginosus* (Gmel.).

1872. *Lepidocyrtus lanuginosus* Tullberg, K. Sv. Vet.-Akad. Handl. p. 38.

1904. *Lepidocyrtus lanuginosus* f. *typica* Ågren, Arkiv f. Zool. p. 24.

A single specimen referable to the type-form was contained in same 2897.

Var. *fucata* (Uzel).

1904. *Lepidocyrtus lanuginosus* ab. *fucata* Ågren, Arkiv f. Zool. p. 24.

This variety was also represented by a single specimen in sample 2924.

Suborder SYMPHYPLEONA Börn.

Family Neelidæ Folsom.

14. *Magalothorax minimus* Willem.

1900. *Megalothorax minimus* Willem, Ann. Soc. Entom. Belg. p. 7.

1912. *Megalothorax minimus* Linnaniemi, Acta Soc. Sc. Fenn. p. 244.

A single individual of this remarkable and minute species occurred in sample 2897.

Family Sminthuridæ Lubb.

15. *Sminthurides aquaticus* (Bourl.) var. *levanderi* Reut.

1912. *Sminthurides aquaticus* var. *levanderi* Linnaniemi, Acta Soc. Sc. Fenn. p. 260.

Numerous individuals of this aquatic species were present in sample 3009—that is, on the surface of standing

water. The var. *levanderi* is known from Scandinavia, Russia, and Germany, but was not included in the lists for Lapland by Ågren or Brown.

GENERAL REMARKS ON DISTRIBUTION.

Collembola have been collected on previous occasions in Lapland, and Ågren (1904) gave a list of thirty-four species and varieties recognised up to that time. In 1931, an account of the Collembola taken by the Oxford University Expedition of 1930 was published (Brown, 1931), in which sixteen species and varieties were noted, of which five were not in the previous list. In the present collection, again, sixteen species are recorded, of which eight do not occur in the list of Ågren, and ten are not in the Oxford University Expedition list, while seven do not appear in either of these lists. These are:—*Friesea mirabilis*, *Xenylla humicola*, *Isotoma olivacea*, f.p., *I. bipunctata*, *Isotomurus palustris* f. *prasina*, *Megalothorax minimus*, *Sminthurides aquaticus* var. *levanderi*.

All these, however, appear to have occurred in some part of Scandinavia previously.

The sample richest in species was that from cushions of Moss and Mossy-Campion taken at 3200 feet in Seiland, in which were nine species, viz.:—*Hypogastrura armata*, *Friesea mirabilis*, *Tetracanthella wahlgreni*, *Folsomia quadrioculata*, *Isotoma viridis*, *I. olivacea*, *I. bipunctata*, *Lepidocyrtus lanuginosus*, *Megalothorax minimus*.

Very similar, though less rich, samples were those collected from cushions of Moss at 2600 feet, and from Mossy-Campion at 1600 feet, also from Seiland.

LITERATURE.

- ÅGREN, H. 1904. "Lappländische Collembolen." Arkiv f. Zool. ii.
 BROWN, J. M. 1931. "Report on the Collembola collected by the Oxford University Expedition to Lapland." Ann. & Mag. Nat. Hist. (10) viii.
 —. 1932. "Report on the Collembola collected by the Oxford University Expedition to Hudson Strait, 1931." Ann. & Mag. Nat. Hist. (10) x.
 HANDSCHIN, E. 1924. "Die Collembolenfauna des schweizerischen Nationalparkes." Mem. Soc. Helv. Sci. nat. lx.
 LINNANIEMI (AXELSON), W. M. 1903. "Weitere Diagnosen über neue Collembolen-Formen aus Finland." Acta Soc. F. et Fl. Fenn. xxv. no. 7.

- LINNANIEMI, W. M. 1907. "Die Apterygotenfauna Finlands." Allgemeiner Teil. Acta Soc. Sc. Fenn. xxxiv. no. 7.
 —. 1912. "Die Apterygotenfauna Finlands." Spez. Teil. Acta Soc. Sc. Fenn. xl.
 LUBBOCK, J. 1867. "Notes on the Thysanura."—Pt. III. Trans. Linn. Soc. Lond. xxvi.
 TULLBERG, T. 1871. "Förteckning öfver Svenska Podurider." Öfv. K. Vet.-Akad. Förhandl. xxviii.
 —. 1872. "Sveriges Podurider." K. Sv. Vet.-Akad. Handl. x.
 —. 1876. "Collembola borealia." Öfv. K. Sv. Vet.-Akad. Förhandl. xxxiii.
 WILLEM, V. 1900. "Un type nouveau de Sminthuride, Magalothorax." Ann. Soc. Ent. Belg. xlv.

LXV.—On the Rate of Growth of *Sacculina carcini* Thompson in *Carcinus maenas* (Pennant). By J. H. ORTON, D.Sc.

CONTENTS.

	Page
Introduction	617
Rate of Growth of <i>Sacculina</i> in <i>Carcinus</i>	617
Life-history of <i>Sacculina</i> in <i>Carcinus</i>	619
Summary	625
References	625

INTRODUCTION.

A specimen of *Sacculina carcini* Thompson was obtained in *Carcinus maenas* (Pennant) under the following experimental conditions, which enable its age to be determined approximately. In this experiment and other similar ones, close determinations have been made of the rate of growth of the common shore crab in the sea (1), and an opportunity thereby provided of re-assessing the rate of growth of *Sacculina* in *Carcinus*.

RATE OF GROWTH OF *SACCULINA* IN *CARCINUS*.

On July 15, 1933, an experimental box was fixed on Cark sands about $2\frac{1}{2}$ miles offshore from Flookburgh in the middle of Morecambe Bay slightly above half-tide level. This box is of the same type as has been described (2); it is about $5\frac{1}{2}$ feet long by 3 feet wide by 10 inches deep, with entire wooden bottom, but with sides and top of perforated zinc, the perforations being 4 mm. in diameter. The lid fits snugly and is screwed home after each visit. The box was put out primarily for following the rate of growth of *Cardium edule*, and an immense collection of some 10,000 young cockles

was obtained in it during the summer of 1933. During frequent inspections of the box it was found that post-larval *Carcinus maenas* settled in the box, fed on the cockles and other animals, and grew rapidly to a relatively large size (2, p. 243) (see Table I.). The crabs were cleared out of the box on every possible occasion to conserve the cockles. The box was first opened on October 3, 1933, and ten crabs removed, the larger having the following carapace width (=C.W.) in mm.: (1) ♂, 26.0; (2) ♂, 24.9; (3) ♀, 22.8, (4) ♀, 19.4. A month later, on December 16, a female *Carcinus* with C.W. 31.0 mm. was removed along with one other small male. Monthly visits were afterwards made until June 23, 1934, after which date absence abroad prevented further

TABLE I.—Rate of growth of *Carcinus maenas* in experimental box with perforations 4.0 mm., Cark sands, 1933–35. (The carapace width of *C. maenas* is given in mm.)

July 15, 1933.	Box put out.
August, September.	Box not examined.
October 3.	♀'s 22.8, 19.4, 17.1, 10.9; ♂'s 26.0, 24.9, 14.5, 9.7.
December 16.	♀ 31.0; ♂ 11.5.
Jan. to May 29, 1934.	Box examined monthly wholly or in part.
June 23.	Box last examined.
July, August.	Box not examined.
September 29.	♀'s 44.6, 43.2; ♂ 37.9, 35.9 with <i>Sacculina</i> .
March 8, 1935.	♀ 44.7 in berry; ♂ 31.0.
June 8.	♀ 23.4; ♂ 19.3, 11.2.

visits until September 29, 1934. On this date twelve *Carcinus* were removed from the box. Four of these were relatively large with C.W. in mm., respectively, 44.6 ♀, 43.2 ♀, 37.9 ♂, and 35.9 ♂, the latter being parasitized by a *Sacculina carcini*, which exhibited an externa 19.5 mm. wide. The parasite had a somewhat soft exoskeleton and was partly greyish yellow and partly reddish; it also contained only young embryos at the time of preservation. The carapace of the *Carcinus* harboured a few small acorn barnacles which have a calcareous base and are probably young *B. crenatus* * spatted in the summer. The abdomen is slightly

* *B. crenatus* is present in abundance on the under side of the box, which in parts is immersed in a pool formed underneath the box.

modified in that segments 3, 4, and 5 are separated by definite sutures but remain ankylosed in the middle region; its general shape is triangular and about intermediate between the normal and modified male abdomen as drawn by Potts (3) as also in the relation

$$\frac{\text{width 4th abd. seg.}}{\text{length of abdomen}} = \frac{11.5 \text{ mm.}}{17.8 \text{ mm.}} = 0.65.$$

Potts's mean figure for the uninfected male is 0.57, and for the maximum modification 0.77.

The infected *Carcinus* had grown in the box some time between July 15, 1933, and September 29, 1934, during a maximum period of $14\frac{1}{2}$ months, but, as in monthly inspections made from December 1933 to June 1934 the larger crabs would mostly be discovered and removed, it is improbable that the crab settled in the box earlier than the end of 1933. Its greatest age is, however, $14\frac{1}{2}$ months plus the time required for the post-larva to grow to a size, *i. e.*, of carapace width 4.5 mm., which could just creep through a circular hole 4 mm. in diameter. If six weeks be allowed for this latter period (see Shen's experiments, 4), the greatest possible age of the infected crab is 16 months.

In five of the experiments recorded in 1 (see Table II. herein, p. 620) crabs larger than the one parasitized with *Sacculina* were obtained at a comparable age, *i. e.*, 43 to 53 mm. C.W. for males and 37 mm. for females. It is not improbable, therefore, that the *Carcinus* with *Sacculina* taken from the Cark box was about one year old; if, however, as is unlikely, the crab had been in the box from July 1933, its size would indicate that growth had been retarded by the parasite. The occurrence of small Balanids on the carapace of the host is a definite indication of absence of recent moulting.

LIFE-HISTORY OF *SACCULINA* IN *CARCINUS*.

In his brilliant well-known study of the development of *Sacculina carcini* in *Carcinus maenas* at Roscoff, Delage (5) tentatively suggested in the light of information then available that *Sacculina* passed one year and nine months inside the crab before erupting to the exterior. In discussing his statistical table, which gives the percentage of infection of infectable crabs, he

remarks, "Si les choses se passent telles que je les indique, les oscillations du tableau se trouvent expliquées; mais il est bon de faire remarquer qu'il en est de même, quel que soit le nombre d'années que l'on intercale entre le moment de l'inoculation et celui où le parasite devient externe, ... Le tableau indique l'époque de l'année où les phénomènes ont lieu, mais non l'âge absolu des Sacculines. Si celles-ci devenaient externes au printemps qui suit l'inoculation, au lieu d'attendre une année entière, ou si, au contraire, elles passaient deux ou

TABLE II.—Minimal incremental growth of *C. maenas* in the sea in a given period from different initial sizes. (Carapace widths in mm.)

1. Maximum initial size at entry * into apparatus.	2. Size at recovery from apparatus.	3. Increment in size.	4. Maximum period (in months) for increment.	5. Maximum estimated age (in months) of crabs recovered.
4.5	26.0 ♂	21.5	2½	4
4.5	22.6 ♀	17.1	2½	4
4.5	31.0 ♀	26.5	5	6½
16.0	43.0 ♂	32.0	10½	13½
16.0	53.0 ♂	37.0	12	15
16.0	37.0 ♀	21.0	12	15
4.5	44.6 ♀	40.1	14½	16
4.5	35.9 ♂ with <i>Sacculina</i> †.	30.4	14½	16
4.5	44.7 ♀ in berry.	40.2	19½	21½

trois ans de plus à l'état interne les nombres du tableau ne seraient pas changés."

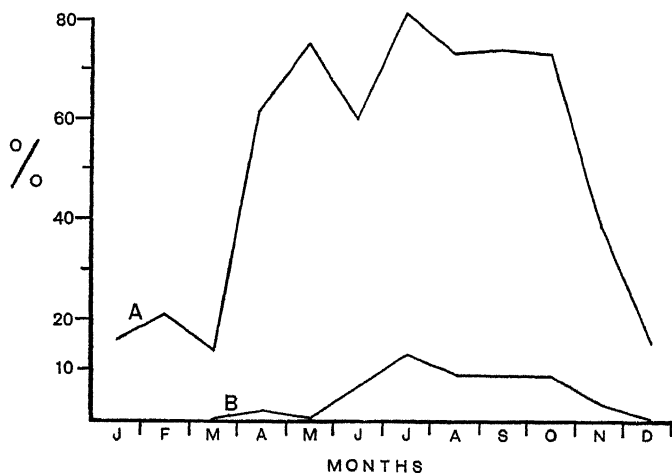
It is clear that Delage felt that he had not enough critical information available; his difficulty lay in absence of knowledge of (a) the rate of growth of *Carcinus*, about which matter he writes "Les auteurs sont malheureusement presque tous muets sur la rapidité de l'accroissement des Crabes," and (b) incomplete knowledge of the breeding period of *Carcinus*. On this latter point he remarks that "c'est vers la fin de l'été que commencent

* Entry may be made at any time at any size less than that given.

† With *Sacculina carcini*.

à apparaître les petits Crabes de 3 à 5 millimètres de diamètre."

Lebour's (6) and Shen's (4) work shows that tiny crabs 2.8 mm. in diameter may be grown from the megalopa in April in the laboratory at an age of about 2 to 3 weeks. In the sea the period is probably less. It is now known also that *Carcinus maenas* breeds all the year round at Plymouth (7, p. 216), and there is little reason to doubt that similar conditions prevail in the neighbouring station at Roscoff, especially as Delage shows that *Sacculina* carries ripe nauplii from



Seasonal variation in percentage of infectable *Carcinus maenas* infected with *Sacculina carcini* externa at Roscoff as observed by Delage (5).

A. Total *Sacculina* externa ; B. Ripe externæ.

April to November at Roscoff, and a similar range is known at Plymouth. (The writer has many personal records for March and April, which supplement those of Garstang (7) for May to September.)

Delage's observations on the seasonal phases in the life-history of *Sacculina* are epitomized in the figure given above and Table III. (p. 622). The essential features are the occurrence of numerous young internæ in autumn, larger internæ in winter (on crabs 25–30 mm.), and large internæ about March, followed by numerous young externæ in April to May (on crabs 30–40 mm.), which develop into

large primiparous externæ in the summer. At the approach of winter* there is shown a greatly reduced percentage of individuals carrying externæ, and this condition persists until the new eruption of externæ in the following April to May. In addition to these facts Delage states that internæ are more or less frequent in crabs 20–30 mm. in size (diameter = carapace width) all through the summer to October, and that young internæ occur (are common?) in crabs so small as 6–12 mm. in diameter in September.

Delage's reasons for estimating the age of the internal phase of *Sacculina* as 21 months are as follows:—
 “en hiver et même en automne des *Sacculines* internes très développées, ayant acquis tous leur caractères définitifs, sur des Crabes de 25 à 30 millimètres de diamètre. Evidemment, ces *Sacculines* n'ont pu être

TABLE III.—Summary of Delage's seasonal observations on the infection of infectable *Carcinus maenas* with *Sacculina carcini* at Roscoff (5). (Diameters = carapace widths of crabs are shown in mm. in brackets.)

Internæ.		Externæ.
Small.	Large.	
Sept. (6–12).	Oct. (25–30) (see p. 673).	60 to 70 per cent., small becoming large during the period April, May, June, and July (30–40).
Oct. (12–15).	Dec. }	Primiparous; ca. 70 per cent., Aug., Sept., Oct. (n.r. †).
Nov. (n.r. †).	Jan. }	
	Feb. }	
	Mar. }	
Summer (20–30 or even 35) ‡.		

Note 1.—Both small and large internæ are recorded as numerous in October, and during the whole summer internæ were found more or less frequent in crabs ranging in size from 20 to 35 mm. (Details of these were not recorded.)

Note 2.—Ripe externæ, i. e., presumably with nauplii, occurred from April to November with a maximum about July; and primiparous forms mainly August to October.

* It is not impossible that migration of infected individuals into deeper water may be an additional factor to those adduced by Delage for the reduction in the percentage of infected individuals found at this period.

† (n.r.) size and proportion not recorded.

‡ More or less frequent; number not recorded (*loc. cit.* p. 674).

inoculées depuis trois ou quatre mois seulement, et les Crabes qui les portent n'ont pu passer dans le même temps de la taille de 12 à 15 millimètres à celle de 25 à 30 millimètres. Donc, la Sacculine ne devient pas externe au printemps qui suit son inoculation. Elle reste interne au moins un an de plus."

In the experiments on growth of *C. maenas* referred to above the increments in width of the crabs recovered from the apparatus are extracted from (I) and given in Table II., column 3. The maximum period in which this increment could have been effected is given in column 4, but as crabs might enter the apparatus after it was exposed in the sea, it follows that the increments shown may have taken place in a shorter period than the total exposure.

These experiments clearly prove that crabs of 12 to 15 mm. may easily grow to 25 or 30 mm. in carapace width in the course of 2 or 3 months. Therefore, unless the parasite causes arrest of growth in the host, *Sacculina* need not necessarily remain internal for a year or more as Delage inferred.

Delage's second reason is similar. He states "En second lieu, les Sacculines qui deviennent externes d'avril à juillet se montrent sur des Crabes de 30 à 40 mm. de large *. Selon moi, ces animaux doivent être âgés d'environ deux ans et doivent avoir vécu trois à quatre mois avant d'être inoculés. Ce qui donne bien un an et neuf mois pour l'âge moyen de la Sacculine qu'ils nourrissent."

Delage's submission that crabs 30 to 40 mm. C.W. must be two years old is not permissible in the light of experiments herein recorded, as this size may readily be attained in one year in uninfected individuals (see Table II., p. 620), and crabs 25 to 30 mm. C.W. in October would normally become at least 30 to 40 in the following April to July, provided once more that infection does not retard growth. There is no clear evidence on this latter point, except that of the experimental crab herein

* Delage usually refers to the diameter of crabs; presumably all his sizes refer to diameter=carapace width. Weldon has shown (8) that $\frac{\text{carapace width}}{\text{carapace length}} = 1.26$ and 1.29 for the localities of Naples and Plymouth, respectively.

recorded, which, though infected with *Sacculina*, grew in a maximum period of 16 months to a size of 36 mm. with a *Sacculina externa* 19.5 mm. wide.

Delage did not suspect dwarfing from infection, and it is doubtful if retardation of growth occurs to any significant extent in view of the experimental record noted above.

The occurrence of small crabs 6-12 mm. C.W. in September with small internæ, and 25-30 mm. in October with large internæ, is apparently an indication of overlapping seasonal infection, since infection is possible from April or earlier to October or later. The seasonal eruption of young externæ found by Delage (see fig., p. 621), along with the direct evidence of the growth and eruption of *Sacculina* in a crab aged at most 16 months, with the known rate of growth of *Carcinus*, together afford virtual proof that the normal life-cycle of *Sacculina* from the cypris stage to the ripe externa is about one year.

In support of this conclusion attention may be drawn to a seasonal statistical study on the developmental stages of *Sacculina carcini* parasitic on *Portunus holsatus* in the environs of the Mersey Estuary by Day (9). Day shows that small internæ occur in high proportion in crabs of various sizes in the early winter period, becoming larger in the late winter. Small externæ increase somewhat in the spring, although not found in a significantly high proportion, but a high percentage of larger (and small) externæ occurs from March to May, when most of the larger ones are producing nauplii. After May a sudden drop occurs in the percentage with externæ, and internæ were not again found in abundance until September to October, as Delage found to be the case in *Carcinus*. Day concludes that there is a yearly cycle, and that the *Sacculina interna* reaches full development in nine months. Since *Portunus holsatus* has a somewhat restricted breeding season, namely March to May, in Mersey Estuary (9), it is possible that the life-cycle of *Sacculina* in this species is more sharply marked than in *Carcinus*, whose breeding period in the English Channel ranges with greater or less intensity over the whole year. *Sacculina* on *Carcinus* also breeds with greater or less intensity during the year at Plymouth, except for possibly

a short period in the winter season, and conditions may be regarded as similar at Roscoff, but probably less extensive in the Irish Sea, in the light of general observations on breeding in marine animals (10)

The life-cycle of *Sacculina* is therefore apparently similar in *Carcinus maenas* at Roscoff, and in *Carcinus maenas* and *Portunus holsatus* in the Mersey Estuary, except that a greater range of the period of infection probably occurs in *Carcinus* in the summer

SUMMARY.

A specimen of *Carcinus maenas* infected with *Sacculina externa* was obtained from experimental apparatus in the sea. The maximum age of the *Carcinus* is 16 months, and the probable age less.

From recent data on the rate of growth of *Carcinus* it is shown that Delage's estimate of the length of the life-history of *Sacculina* in *Carcinus* based on unknown data is probably over-estimated by one year, and that the normal cycle is twelve months or less.

REFERENCES

- (1) ORTON, J. H. 1936. On the Rate of Growth of some Crustacea Decapoda. Journ Mar Biol Assoc vol xx p 673
- (2) ——— 1926. 'On the Rate of Growth of *Cardium edule* — Part I Experimental Observations' *Ibid* vol xiv no 2, pp 243, 277
- (3) PORTS, F. A. 1910. 'Observations on the Changes in the Common Shore crab caused by *Sacculina*' Proc Camb Phil Soc vol xv p 96
- (4) SHEN, C. J. 1935. 'An Investigation of the Post larval Development of the Shore crab, *Carcinus maenas*, with special reference to the External Secondary Sexual Characters' Proc Zool Soc London 1 pp 1-23
- (5) DELAGE, Y. 1884. 'Evolution de la Sacculine (*Sacculina carcini* Thoms) crustace endoparasite de l'ordre nouveau des Kentrogonides' Arch de Zool Exp et Gen 2 sér, T II pp 670 683
- (6) LEBOUR, M. V. 1928. "The Larval Stages of the Plymouth Brachyura" Proc Zool Soc London, pp 491, 518
- (7) 'Plymouth Marine Fauna,' 2nd edition, pp 179 & 216, 1931
- (8) WELDON, W. F. R. 1894. 'On certain Correlated Variations in *Carcinus maenas*' Proc Roy Soc London, vol lrv p 323
- (9) DAY, J. H. 1935. "The Life history of *Sacculina*" Quart. Journ Micr Soc vol lxxvii pt iv p 549
- (10) ORTON, J. H. 1920. Sea temperature, Breeding, and Distribution in Marine Animals" Journ Mar Biol Assoc vol xii no 2

LXVI.—*Neue Borkenkäfer* (Scolytidæ, Col.) *aus Indien*.
 Von HANS EGGERS, Stolberg (Harz).

IN 'Determinationssendungen des British Museum und des Imperial Institute of Entomology' habe ich eine Anzahl neue Arten gefunden, die z. T. an Culturpflanzen leben und daher vielleicht eine besondere Aufmerksamkeit verdienen. Grossenteils stammen sie aus dem Staate Mysore und sind von Dr. K. Kunhi Kannan eingesandt.

Ausser den neuen Arten befanden sich in den Sendungen noch:—

Stephanoderes uniseriatus m. (beschrieben aus dem Congo-staat). Sakalaspur, 21. xi. 1930, in dry coffee berry, 4 Stück; Coorg, x. 1930, on Arabica coffee, 6 Stück; Coorg, Liberica coffee, 3 Stück; Calicut, 2 Stück; und 1 Stück von Hosanella estate on *Castor* twig.

Stephanoderes javanus m. Jakkur, 20. ix. 30, on Purpl plant, 4 Stück.

Stephanoderes cassiæ Eichh. Sakalaspur, 21. viii. 1930, on *Crotolaria* dry twig.

Stephanoderes areccæ Hornung. Sakalaspur, on *Castor*, x. 1930, 8 Stück, on dry coffee berry, 9 + 4 Stück.

Coccotrypes magnus Beeson. Hurudi estate, Hambal, on *Caryota urens* seeds, 2 Stück.

Thamnurgides cardamomi Schauf. Gantenaiik estate, 21. viii. 1930, on *Cardamon* fruits, 5 Stück; Sakal spur, 10. viii. 30, on *Eugenia jambolana* fruits, 2 Stück.

Xyleborus pseudovalidus m. Balehonnur farm, 27. ix. 1930, 3 Stück.

Stephanoderes hampei Ferr. "From Coffee seeds from Kuallumpur" (Coimbatore, 1932); "on fruits, *Coffea liberica*," Malay Peninsula: Banting-town, 30. vi. 1932, G. H. Corbett leg.; Mysore: Rama Krishna-puram, leg. K. K. Sartry, "on Cotton bolls."

Xyleborus semigranosus Bldf. South India: Mukottu Mudi Estate (Anamallais), S. A. Rau leg., i. 1933 "on *Grevillea*."

Xyleborus fornicatior Eggers. South India: Travancore, Wallardie Estate, xi. 1931. S. A. Rau leg., "on tea."

Anschliessend beschreibe ich die neuen Arten,

Crypturgus beelsoni, sp. n.

Sehr schmal und langgestreckt, pechschwarz, glänzend, ausserst fein und kurz behaart.

Kopf leicht gewölbt, fein und dicht punktiert.

Halsschild des ♂ schmal, vollkommen parallelseitig, um die Hälfte länger als breit, Hinterecken kaum abgestumpft, Vorderrand breit gerundet, beim ♀ um ein Drittel länger als breit, nicht ganz parallelseitig, seitlich kaum merklich ausgebaucht. Oberseite leicht gewölbt, glänzend, dicht und deutlich, aber nicht grob punktiert, ohne deutliche Mittellinie.

Flugeldecken beim ♂ deutlich breiter, beim ♀ wenig breiter als Halsschild und in beiden Geschlechtern etwa $1 \frac{2}{3}$ mal so lang wie dieses; parallelseitig, am Ende beim ♀ fast im Halbkreise abgerundet, beim ♂ schmaler nach der Naht zu verengt. Oben leicht gewölbt, ohne Eindruck um das Schildchen und ohne vertiefte Nahtpunktreihe. Punktzeilen ziemlich kräftig, rund und dicht punktiert, nicht vertieft. Zwischenräume schmal, glänzend, ausserst fein und weitläufig punktiert und ausserst fein und kurz, nur mit scharfer Lupe erkennbar, behaart.

Länge: 1 mm.

Fundort: Kaschmir, an *Cedrus deodara*; Chakrata (U.P.); Siuni (Almora, U.P.), an *Pinus longifolia*. Typen in Sammlung des indischen Forstinstituts (Forest Research Institute and College) in Dehra Dun und in Sammlung Eggers. Zur Bestimmung eingesandt durch Dr. C. F. C. Beeson und diesem gewidmet.

Stephanoderes ampliatus, sp. n.

Ein gedrungener, gegen das Flugeldeckenende leicht verbreiteter Käfer, aus der Verwandtschaft von *St. uter* und *alter* m. aus dem Sunda-Gebiet.

Cylindrisch, ziemlich breit, pechbraun, leicht glänzend, Halsschildvorderrand trägt 2 Höcker, Hocke der vorderen Hälfte wenig zahlreich, Absturzzwischenräume beschuppt und fein behaart.

Kopf breit gewölbt, fein hautartig genetzt und punktiert, über den Mundteilen eine flach erhabene, glatte Fläche.

Halsschild breiter als lang, Hinterecken abgerundet, Seiten stark gerundet, Vorderrand trägt in der Mitte 2 feine Höcker. Oben kraftig gewölbt, hinter den Randhöckern 2 weitstehende, dann ein Bogen von vier weitstehenden spitzen Höckern, dahinter einige dichtstehende und verwachsene stumpfe Höcker auf dem Buckel, hintere Hälfte ist fein und undeutlich punktulierte, das ganze Halsschild weitläufig hell behaart.

Flügeldecken mindestens doppelt so lang und ebenso breit wie das Halsschild, fast parallelseitig, im Beginn des letzten Viertels deutlich etwas verbreitert. Punkstreifen mässig gross aber flach punktiert, nicht vertieft. Zwischenräume breit und flach, äusserst fein und undeutlich punktulierte und fein behaart. Absturz beginnt hinter der Mitte und ist kraftig abgewölbt. Zwischenräume hier einreihig, der zweite unregelmässig zweireihig sehr fein gekornt und dicht beschuppt und dazwischen kurz fein behaart.

Länge : 2 mm.

Fundort : Brit. Indien (Mysore : Jakkur, 20 ix. 1930), "on Purpli plant," gesammelt von Dr. K. Kunhi Kannan. Type im Brit. Museum, Cotype in coll. Eggors.

Von den Verwandten, *St. uter* und *aller* m., unterscheidet der Käfer sich durch breitere Form, spärlichere Höcker auf dem Halsschild und die aus Haaren und Schuppen gemischte Bekleidung auf den Zwischenräumen des Absturzes.

Stephanoderes erythrinae, sp. n.

Cylindrisch, glänzend, braun, fein und ziemlich dicht behaart.

Kopf fein punktiert mit schmaler Mittellinie, die nicht besonders erhaben ist.

Halsschild etwas breiter als lang, Seiten bis zur Mitte parallel, dann im Halbkreis nach vorn gerundet. Vorderrand trägt in der Mitte 2 dicht gestellte Höcker und etwas weiter auseinanderstehend jederseits noch 2 Höcker und ist etwas vorgezogen. Höckerflock besteht aus kleinen, ziemlich dicht stehenden Höckern und schliesst etwa in der Mitte breit ab, hintere Hälfte des Halsschildes fein und dicht punktiert und das ganze Halsschild fein behaart.

Flügeldecken $2\frac{1}{2}$ mal so lang und ebenso breit wie das Halsschild, parallelseitig bis $\frac{4}{5}$ der Länge, dann stark verschmälert und abgerundet. Reihen deutlich und dicht punktiert, aber nicht vertieft, und fein kurz behaart. Zwischenräume flach, sehr fein punktulierte und absteigend, ziemlich lang und deutlich behaart. Absturz mässig stark abgewölbt.

Länge : 1.5 mm.

Fundort : Brit. Indien (Sakalaspur), 19. vii. 1930, an *Erythrina*.

Type und Cotypen im Brit. Museum, Cotypen auch in coll. Eggers.

Ernoporus concentralis, sp. n.

In Form und Beschuppung und den Höckern des Halsschildes dem *Ern. tiliae* Panz. verwandt, aber durch Furche auf dem Absturze der Flügeldecken deutlich verschieden.

Kurz cylindrisch, vorn verschmälert, hinten breit abgerundet.

Kopf breit gewölbt, sehr fein und dicht punktulierte und fein und kurz behaart, unterhalb der Augen ein leichter Quereindruck, über den Mundteilen länger behaart. Fühlerkeule ist gross und länglich mit einer behaarten Naht, concentrisch zum Aussenrande.

Halsschild ist wesentlich breiter als lang, vor den abgerundeten Hinterecken etwas ausgebogen, dann vor der Mitte stark verschmälert zum Vorderrand abgerundet. Basis fein gerandet. Seiten- und Basaldrittel fein und dicht punktulierte und mit kurzen, grauen Schuppen bedeckt. Vorderrand einfach, ohne Höcker, dahinter ein grosser Höckerfleck bestehend aus vier getrennten Reihen von Querhöckern, die Höcker der ersten beiden Reihen stehen getrennt, die der hinteren Reihen sind ineinander verwachsen. Den Abschluss bilden nach hinten 2 concentrische Querovale ebenfalls verwachsener Höcker. Schildchen deutlich, rundlich.

Flügeldecken nicht breiter und doppelt so lang wie Halsschild, parallelseitig und hinten sehr breit abgerundet. Punktreihen schwach vertieft, deutlich punktiert, Zwischenräume unregelmässig dicht punktiert und dicht mit kurzen Schuppen besetzt. Absturz ist steil abgewölbt,

die Naht leicht erhaben, der zweite Zwischenraum eingedrückt, der dritte erhaben und verdickt und dicht mit Schuppen bedeckt, während der erste (Naht-) und vierte Zwischenraum deutlich einreihig beschuppt sind, die andern unregelmässig beschuppt. Die Furchen des zweiten Zwischenraums ist unbeschuppt.

Länge : 1.4 mm.

Fundort : Vorderindien, Mysore : Sakalaspur, 3. viii. 1930, "from *Dalbergia latifolia* twig." Type und Cotypen im Brit. Museum. Cotypen auch in coll. Eggers.

Thamnurgides cinnamomi, sp. n.

In Form und Grösse mit *Th. myristicæ* Roepke (syn. *sundaensis* m.) am nächsten verwandt, unterschieden durch schwächere Skulptur des Halsschildes, weitläufiger gestellte Reihenpunkte der Flügeldecken, etwas schmälere Gestalt.

Cylindrisch, pechbraun, glänzend, ziemlich lang abstehend behaart.

Kopf ziemlich schmal, gewölbt, mit feiner erhabener Mittellinie, deutlich und ziemlich dicht punktiert und einzeln lang behaart.

Halsschild kurz eiförmig, etwas länger als breit, von den abgerundeten Hinterecken im flachen Bogen nach vorne abgerundet und verschmälert. Oben flach gewölbt, über die ganze Fläche mit sehr feinen Körnchen bedeckt, nur einzelne, unregelmässig verteilte Körnchen etwas grösser, ziemlich weitläufig lang behaart, ohne Mittellinie.

Flügeldecken etwas schmaler und $1\frac{1}{2}$ mal so lang wie das Halsschild, fast parallelseitig, nur in der Mitte leicht verbreitert, hinten plump abgerundet. Oben bis weit hinter die Mitte nur flach gebogen, dann kräftig abgewölbt. Deutlich in Reihen punktiert, Reihenpunkte etwa um den eigenen Durchmesser von einander getrennt. Reihen nicht vertieft, Zwischenräume flach, feiner und etwas weitläufiger in Reihen punktiert und abstechend ziemlich lang behaart. Absturz ohne Eindruck und genau so skulptiert und behaart wie die Scheibe.

Länge : 2 mm.

Fundort : Ceylon (Peradeniya), 7. vii. 1931, Sammler Dr. J. C. Hutson ("boring seeds of *Cinnamomum zelanicum*"). Type und Cotypen No. 8231 im British Museum, Cotypen auch in Sammlung Eggers.

Thamnurgides indicus, sp. n.

Schlanker als *Th. cinnamomi* m., mit stärker gehöcker-tem und längerem Halsschild.

Cylindrisch, pechbraun mit pechschwarzem Kopf und Halsschild, glänzend, mit ziemlich langer Behaarung.

Kopf breit gewölbt, stark runzelig punktiert mit feiner erhabener Linie auf der Stirn, einzeln, lang behaart; über den Mundteilen etwas eingedrückt und dicht goldgelb behaart.

Halsschild etwas länger als breit, von den etwas abgerundeten Hinterecken nach vorn nur ganz schwach ausgebogen, in der vorderen Hälfte eiförmig verschmälert und abgerundet. Oberseite flach gewölbt, dicht mit Höckern und langen Haaren besetzt, die Höcker werden im Basalfeld kleiner und in dessen Mitte gehen sie in weitläufige Punkte über. Seiten im ersten Drittel deutlich, aber nicht scharf gekantet.

Flügeldecken kaum merklich breiter und um die Hälfte länger als das Halsschild, parallelseitig bis zum letzten Drittel, dann leicht verschmälert und abgerundet. Oberseite in der Quere gut gewölbt, in der Länge eben bis zum letzten Drittel, dann gut abgewölbt. Reihenspunkte sind mässig gross, um ihren Durchmesser von einander getrennt, flach, die Reihen nicht eingedrückt. Zwischenräume sind flach mit einer Reihe etwas weiter gestellter feiner Punkte, welche lange abstehende Haare tragen. Auf dem gleichmässig abgewölbten Absturz sind die Punktreihen auch nicht vertieft, die Zwischenräume tragen hier feine, noch etwas weitläufigere, haartragende Punktkörnchen.

Die Vorderschienen tragen 4 Zähne an der Aussen-seite.

Länge: 1.6–2 mm.

Fundort: Brit. Indien, Mysore State: Sakalaspur, 25. viii. 1930, an *Terminalia belerica* (Type im Brit. Museum). Ferner Coorg, Sept. 1930, an *Liberia coffee*; Oct. 1930, on *Arabica coffee*; Sakalaspur, 23. xi. 1930, in dry "Thary" seeds, in dry "Shiduvala" seeds; from *Artocarpus lakucha*; from *Eugenia jambolana* fruits. Balehonnur farm, from a kind of "hara" nut. Somsay Estate, from *Liberica coffee* berries. Cotypen im Brit. Museum und in coll. Eggers.

Coccotrypes impressus, sp. n.

Gross, fast langelliptisch, pechbraun, glänzend, in Reihen lang behaart, Absturz flach eingedrückt.

Kopf breit gewölbt, zwischen dichten Längsrissen fein punktiert und spärlich behaart.

Halsschild so lang wie breit, seitlich flach gerundet, vorn etwas verengt und vorgezogen mit 9–10 flachen Vorderrandhöckern. Oben mässig gewölbt; vorn in der vorderen Hälfte mit kräftigen und kleineren Rundhöckern und längeren Haaren besetzt; seitlich stehen dichte, aber flache Längsrünzeln, in der Mitte vor der Basis breitere, flache Höcker und einzelne Punkte. Basis leicht gerandet.

Flügeldecken wenig schmaler als die grösste Breite des Halsschildes und etwa um die Hälfte länger als dieses, bis zur Mitte parallelseitig, dann verschmälert und eiförmig abgerundet. Oben fast in einem Bogen langsam abgerundet, Punktreihen sind in der vorderen Hälfte nicht vertieft, tragen ziemlich grosse flache Punkte mit feinen, mässig langen Haaren. Zwischenräume ganz flach mit feinen Reihenpunkten, die seitlich in feine Punktkörnchen übergehen und lange abstehende Haare einreihig tragen. Absturz beginnt etwa in der Mitte der Flügeldecken und ist auf den Nahtzwischenräumen flach eingedrückt. Erste und zweite Punktreihe sind deutlich eingedrückt und tragen noch grössere Punkte als die anderen. Nahtzwischenraum trägt hier nur feine, weitläufige Punkte, die anderen deutliche Punktkörnchen. Behaarung auf dem Absturz doppelt wie im Basalteil.

Länge : 2.8 mm.

Fundort : Singapore, leg. Baker. Type und Cotype in coll. Eggers.

Xyleborus conidens, sp. n.

Nahe verwandt mit *X. haberkorni* m., welcher nicht nur in Ostafrika, sondern auch in Ostindien vorkommt. Die neue Art unterscheidet sich durch starken Glanz, durch stärkere und anders gestellte Zähne und vor dem Ende erhabene und gehöckerte Naht.

♀: Kurzcyllindrisch, glänzend, rotbraun mit dunkelbraunen Flügeldecken, vorne kaum behaart, hinten kahl.

Kopf kräftig gewölbt, äusserst fein hautartig genetzt mit einzelnen flachen Punkten, über dem Munde spärlich behaart.

Halsschild so lang wie breit, hinten parallelseitig, vorne kräftig gerundet mit 2 aufgebogenen Zähnen in der Mitte des Vorderrandes, daneben zu beiden Seiten einige kleinere Höcker. Vordere Hälfte ist mit fast concentrisch geordneten Höckern ziemlich dicht bedeckt und spärlich behaart. Basalhälfte kaum sichtbar fein hautartig genetzt, glänzend mit zerstreuten, feinen Pünktchen. Schildchen ziemlich gross, hinten gerundet.

Flügeldecken parallelseitig bis zum zweiten Drittel, dann im schwachen Bogen zur Naht abgeschrägt. Punktreihen nicht eingedrückt, zeigen mässig grosse Punkte, nur die erste Reihe stärkere, die seitlichen sind schwächer punktiert. Die Zwischenräume sind äusserst fein einreihig punktuert. Der Absturz beginnt eben vor der Mitte, ist abgeschrägt, in der Mitte neben der erhabenen Naht flach eingedrückt. Vor dem scharf ausgeprägten Hinterrand ist die Absturzfläche etwas gewölbt. Die Naht ist gegen das Ende stärker erhaben mit einigen feinen Höckern; die Punktreihen sind deutlich, die Pünktchen der Zwischenräume z. T. verloschen. Der zweite Zwischenraum trägt am Beginn des Absturzes einen kräftigen, kurzkegeligen Zahn, der schräg nach oben und hinten gerichtet ist. In etwas grösserem Abstände als die Entfernung dieser beiden Zähne von einander folgt auf dem dritten Zwischenraum ein gleichstarker und ebenso gerichteter spitzer Kegel. Seitenrand der Flügeldecken ist fein und ziemlich lang behaart.

Länge: 1.8 mm.

Fundort: Mysore: Wynaad, on coffee, Jan. 1931. Type im Brit. Museum, Cotype in Sammlung Eggers.

Cylindrotomicus * *squamulosus*, sp. n.

Langcylindrisch, schmal, pechbraun, wenig glänzend, weissbeschuppt.

Kopf an der Stirn stark gewölbt und fein hautartig genetzt, zwischen Augen und Mundteilen rauh punktiert und spärlich behaart. Augen gross, nierenförmig, ohne

* Gen. nov. Die Beschreibung dieser Gattung erscheint in einer anderen Arbeit.

besondere Einbuchtung über dem Fühleransatz. Vor dem Fühleransatz ein runder Höcker.

Halsschild etwas länger als breit, mit fast rechteckigen Hinterecken, seitlich parallel bis zur Mitte, dann verschmälert und in guter Rundung in den Vorderrand übergehend. Seitenrand in der hinteren Hälfteangedeutet, aber nicht scharfkantig. Oberseite im Basalteilmässig gewölbt, vordere Hälfte flach abgewölbt, in der Mitte ein feiner Querbuckel. Das Halsschild ist mässig glänzend, fein und dicht punktuliert und mit feinen, kurzen aufliegenden Haaren bedeckt; in der vorderen Hälfte zieht sich eine dicht gestellte Reihe von Höckern von der Mitte des Vorderrandes seitlich im Bogen in die Höhe, da hinter 2 lockere Querreihen von Höckern in grösseren Abständen von einander und vor der Mitte ein schmales Querfeld mit dichter, stehenden, feinen Höckern.

Schildchen flach, rund.

Flügeldecken ebenso breit und fast doppelt so lang wie das Halsschild, parallelseitig bis hinter das dritte Viertel, dann wenig verschmälert und breit abgerundet. Oben in der Länge eben, im letzten Drittel gut abgewölbt, in der Quere gut gewölbt. Punktreihen fein und dicht punktiert, nicht eingedrückt. Zwischenräume ganz flach, ebenso fein und dicht einreihig punktiert und einreihig mit einer dichtstehenden Reihe weisser, breiter Schuppen besetzt. Auf dem leicht flach gedrückten Absturz tragen die Zwischenräume an Stelle der Punkte feine Körnchen, welche durch die Schuppen fast verdeckt werden.

Länge : 1.8 mm.

Fundort : Vorderindien (Mysore : Jakkur) von Dr. K. Kunhi Kannan gesammelt, "on a wild creeper," 20. ix. 1930. Type und 2 Cotypen im British Museum, 1 Cotype in Sammlung Eggers.

Webbia camphoræ, sp. n.

Diese neue Art ist verwandt mit *W. imitator* m. von den Philippinen, aber kürzer behaart, mit grösseren Körnern auf den Zwischenräumen der Flügeldecken und mit längerem Halsschild.

Kurzcylindrisch, pechschwarz mit hellbraunen Beinen und Fühlern, mässig glänzend, mit mässig dichter, kurzer Behaarung.

Kopf gewölbt, Stirn fein hautartig genetzt, fein und weitläufig punktuiliert mit angedeuteter, fein erhabener Mittellinie; über dem Munde sehr dicht, fein und rauh punktuiliert; der ganze Kopf fein, aber dünn und kurz behaart.

Halsschild fast doppelt so lang wie breit, parallelseitig bis vor die Mitte, dann breit abgerundet. Das vordere Drittel kräftig abgewölbt und gleichmässig fein gehöckert und spärlich behaart; die hinteren zwei Drittel eben, in der Quere gut gewölbt, fein hautartig genetzt und spärlich fein punktuiliert, mattglänzend.

Schildchen so lang wie breit, hinten abgerundet.

Flügeldecken gleich breit und kaum länger als das Halsschild, parallelseitig bis zum letzten Viertel, dann schräg zur Naht abgerundet. Das kurze Basalfeld ungestreift, glänzend, mit feinen Pünktchen unregelmässig durchsetzt. Der übrige Teil der Flügeldecken matt, tief gestreift, ohne erkennbare Punkte in den Streifen; die Zwischenräume erhaben, vorne ziemlich breit, auf dem Absturz verschmälert, vorne zuerst unregelmässig zweireihig punktiert und kurz ebenso behaart, hinten einreihig mit kräftigen Körnchen in mässigen Abständen einreihig besetzt und einreihig kurz behaart. Der Seitenrand des Absturzes trägt längere Haare.

Länge: 1.7 mm.

Fundort: Johore: Kluang, 12. vii. 1932, "in Camphor wood." Type und Cotypen im British Museum, Cotypen auch in Sammlung Eggers.

Craniodicticus minor, sp. n.

Der Gattungstypus *Cr. mucronatus* Bldf. von Ceylon ausserordentlich ähnlich, von ganz gleicher, eigenartiger Gestalt.

Er unterscheidet sich von der Gattungstypus durch viel geringere Länge; der Kopf ist hautartig genetzt, matt, Punktur kaum erkennbar. Halsschild ist weniger verengt als bei der grösseren Art, sonst ähnlich vorne punktiert, hinten glatt.

Die Flügeldecken sind ebenfalls kräftig in vertieften Reihen punktiert, die Zwischenräume erhaben und vor dem Absturz mit Ausnahme der Naht in ein feines Zähnchen ausgezogen, die ungeraden Zw. sind hier

stärker gezähnt als die geraden. Die Höcker des Seitenrandes des schwach punktierten Absturzes, der fast matt erscheint, sind stärker als bei *mucronatus*, die beiden Nahthöcker am Hinterrande sind auch ungleich, der rechte länger als der linke.

Länge : 1-1.2 mm.

Fundort : Indien, Coorg : Mercara, (C. F. C. Beeson leg., 8. vii. 1933. Type und Cotype in coll. Eggers.

Ich habe die neue Art mit Cotypen von *Cr. mucronatus* Bldf. aus der Sammlung Lewis im Brit. Museum verglichen.

LXVII.—*New and little-known Fossil Mammals from the Pleistocene of Kenya Colony and Tanganyika Territory.*

—I. By A. TINDELL HOPWOOD, D.Sc., F.L.S., Department of Geology, British Museum (Natural History).

THE collection of fossil mammals from the Pleistocene deposits of British East Africa in the British Museum (Natural History) has recently been enriched by the addition of long series of specimens collected by Dr. L. S. B. Leakey and his companions during the years 1931/1932, 1934/1935, as well as by specimens received from other sources. The amount of material is so great that some considerable time must necessarily elapse before the final report is complete, but a short series of diagnoses of the various novelties, and notes on other features of interest, may be helpful to those who work on the natural history of Africa.

Owing to the excellent manner in which the geology of the Olduvai region is displayed in the field, that locality may be taken as the standard section of the Middle Pleistocene in East Africa. For this reason, the type-specimens on which the new species are based have been selected from among the fossils from Olduvai as far as possible.

The numbers refer to the Departmental Registers. The horizon given for species founded on types from Olduvai is that stratum in which the specimens mentioned were found. There are four beds, of which Bed I. is the oldest and Bed IV. the youngest; the general geological age is Middle Pleistocene. Kanjera and the Vogel River

(Laetolil) Beds are also Middle Pleistocene. Kanam East and Kanam West are Lower Pleistocene. Rawi, Kagua, and Kagua Flats are probably of the same age as the Kanam Beds, but I understand from Prof. Boswell that the exact stratigraphical relationships are not clearly shown in the field.

Order PRIMATES.

Family Cynopithecidae.

Genus *SIMOPITHECUS* Andrews, 1916.

Simopithecus oswaldi Andrews.

1916. Ann. & Mag. Nat. Hist. (8) xviii. p. 410, pl. xv.

Dr. Leakey found the exact spot at Kanjera (Homa Mt.) from which Dr. Felix Oswald collected the type-specimens, and recovered many pieces which form part of those specimens. He also collected a fairly complete skull of a female (M 14936), as well as numerous fragmentary remains of other individuals.

Dimensions (in mm.) :—

Female skull, registered M 14936 :

Greatest length	172
Condylbasal length	133
Zygomatic breadth (as restored)	115
Postorbital constriction	51
Palatal width at M 2	38 est.
Length of premolar-molar row (alveolar)	53

Simopithecus leakeyi Hopwood.

1934. Ann. & Mag. Nat. Hist. (10) xiv. p. 547.

A mandibular ramus of a female (M 14938) from Bed I. at Olduvai has the premolar-molar series 72 mm. in length; the M 3 measures 21.9 mm. A similar ramus from Bed II. has the premolar-molar series of approximately the same length—P 3 is damaged,—but M 3 is 26 mm. long.

An isolated second upper molar (M 14939), also from Bed II., measures 20.6×14.6 mm., index 71.

Genus *CERCOCEBUS* E. Geoffroy, 1812.

Distinguished from *Colobus* by the shape of the corpus mandibulæ, the structure of the third molar, and the

pronounced basal swelling of the labial cusps of the lower cheek-teeth.

Cercocebus ado, sp. n.

Diagnosis.—A *Cercocebus* in which the female has the premolar-molar series nearly 45 per cent. longer than that of a female *C. galeritus* and approximately equal to that of a very large *C. torquatus torquatus*. Cusps of lower cheek-teeth higher and more slender than in either of the Recent species; talonid of lower M 3 stronger.

Holotype.—A weathered left mandibular ramus of a female (M 14940).

Horizon.—Middle Pleistocene, Vogel River (Laetolil) Beds.

Locality.—Approximately long. 35° 10' E., lat. 3° 10' S.

Dimensions (in mm.):—

Length of premolar-molar series.....	46.2
Length of M 3	12.5
Breadth of M 3	10
Length-breadth index of M 3	80

Remarks.—The third lower molar of a female *C. galeritus* in the Zoological Department of the British Museum (regd. no. 23-10-15-3) measures 7.6 × 6 mm., index 79; whereas the corresponding tooth of the largest male *C. t. torquatus* in the same collection (regd. 2-11-2-1) measures 9.4 × 8.6 mm., index 91.

Trivial name *ādo*, Masai=tall, big.

Order PROBOSCIDEA.

Family Deinotheriidae.

Genus *DEINOTHERIUM* Kaup, 1829.

Deinotherium bozasi Arambourg.

1934. Bull. Soc. Géol. France, (5) iv. p. 309, pl. xvii.

The earlier specimens of this species from Olduvai were found in Bed I.; a fragment of a tooth (M 14945) has now been found in Bed II. Broken teeth (M 14946) are known from the Vogel River (Laetolil) Beds. The teeth of *Deinotherium* reported from Kanam ('Man,' 1933, Art. 66) probably belong to this species.

Family **Elephantidæ**.

Genus **PALÆOLOXODON** Matsumoto, 1924.

Palæoloxodon antiquus recki (Dietrich).

1916. *Elephas antiquus recki* Dietrich, Arch. f. Biontol. Berlin, iv. Heft 1, p. 22, pls. i.-viii.

Specimens of the anterior milk-molar have been discovered at Olduvai. Two have the following metrical characters :—

	M 14943.	M 14944.
Length (in mm.)	21.3	24.4
Breadth	16.9	18.2
Height	17.5	22
Plate formula	$x\ 3$	$x\ 3$
Length-lamellæ quotient	6.1	7

Remains of this animal, mostly fragmentary, were found in the Vogel River (Laetolil) Beds. The dimensions of two specimens of the third lower milk molar, a tooth hitherto unrecorded from any locality, follow :—

	M 14941.	M 14942.
Length (in mm.)	58.0	72
Breadth	worn.	36.5 ost.
Height	worn.	29.5
Plate formula	$x\ 5\ x\ ?$	$x\ 6\ x$
Length-lamellæ quotient	6.7	10.3

The identity of these two specimens is important, because it proves the age of the Vogel River (Laetolil) Beds to be Middle Pleistocene, *i. e.*, they are of the same general age as Beds I.-IV. at Olduvai.

Order **UNGULATA**.

Suborder **ARTIODACTYLA**.

Family **Bovidæ**.

Genus **BULARCHUS**, gen. nov.

Diagnosis.—Bovidæ of large size with massive horn-cores, compressed from back to front, oval in cross-section, closely approximated at their bases, curving crescent-wise upwards, outwards, and downwards. So far as known, the horns are in the same plane as the face and are not spirally twisted.

Genotype.—*Bularchus arok*, sp. n.

Bularchus arok, sp. n.

Diagnosis.—A *Bularchus* in which the span of the horn-cores measures two metres, or more, from tip to tip.

Holotype.—A frontlet with two incomplete horn-cores and distorted brain-case (M 14947).

Paratype.—A frontlet with part of the left horn-core and the extreme base of the right (M 14948).

Horizon.—Middle Pleistocene; holotype and paratype from Bed IV. at Olduvai.

Localities.—Kanjera, Olduvai.

Dimensions (in mm.) :—

	M 14947.	M 14948.
Span across horn-cores	1800	..
Length of left horn-core	1090	620
Circumference at base	485	445
Maximum diameter at base	172	167
Minimum diameter at base	108	105 est.
Width across occipital condyles ..	136	..

Remarks.—Distinguished from all other members of the Bovidae by the untwisted, closely set horns shaped like inverted crescents. Dr. G. E. Pilgrim suggests that it may be a very advanced member of the bubaline group in which the anterior keel on the horn-cores has been suppressed. The tip of a horn-core (M 14949) appears to have an obsolete keel on its superior margin.

Generic name *βουλάρχος*, president of the council; trivial name *ārok*, Masai=buffalo.

Genus HIPPOTRAGUS Sundevall, 1844.

Hippotragus niro, sp. n.

Diagnosis.—A *Hippotragus* with horn-cores of the same type as those of *H. niger*, but with well-developed knots on the anterior surface at intervals of about 70 mm. Knots continued on to the lateral and medial surfaces as indistinct rings.

Holotype.—The broken right horn-core of an immature animal (M 14561).

Horizon.—Bed IV.

Locality.—Olduvai.

Dimensions (in mm.) :—

Length along front curve	245
Circumference at base	170
Maximum diameter at base	59
Minimum diameter at base	50

Remarks.—This species agrees with *H. niger*, and differs from *H. equinus*, in that the medial surface of the horn-core is flattened so that the cross-section is more nearly D-shaped than regularly oval.

Trivial name *nirö*, Masai=brown, the colour of the holotype.

Family Giraffidæ.

Genus *SIVATHERIUM* Falconer & Cautley, 1836.

Sivatherium olduvaiensis (Hopwood).

1934. *Helladotherium olduvaiensis* Hopwood, Ann. & Mag. Nat. Hist. (10) xiv. p. 549.

Palmated antlers of the *Sivatherium* type from Olduvai (M 14954–14955), Bed II., and from Kagua (M 14956) make it reasonably certain that the short-legged member of the giraffe group should be referred to *Sivatherium*. The antlers are not so widely palmate as in *S. giganteum* and terminate in a recurved point.

Genus *GIRAFFA* Zimmermann, 1780.

Giraffa cf. *capensis* subsp.

Bones and teeth of long-legged giraffes closely allied to *G. capensis* were collected from the Olduvai beds in 1931 and the following years. The same species is represented by a crushed skull and partial skeleton (M 14957) collected at Rawi by the expedition of 1934–1935. The skull shows no trace of a median horn.

LXVIII.—On a new Ammonite Genus (*Sphenarpites*) from the Lias of Baluchistan. By L. F. SPATH, D.Sc., F.G.S.

(a) INTRODUCTION.

On various occasions since 1921* and again recently † I have had occasion to mention a suite of Liassic fossils in the British Museum (Cook, ex Geological Society, Collection) from Kelat, Baluchistan, chiefly because

* Spath, "On Cretaceous Cephalopoda from Zululand," Ann. S. Afr. Mus. vol. xii. pt. vii. no. 16, p. 272.

† Spath, "Bajocian Ammonites and Belemnites from Eastern Persia (Iran)," Mem. Geol. Surv. India, Pal. Indica, n.s. vol. xxii. Mem. no. 3.

it includes an example of the rare genus *Bouleiceras*, a characteristic element of the Domerian-Toarcian fauna of Madagascar. In addition, there are specimens of various forms of *Phylloceras*, *Rhacophyllites*, *Lytoceras*, *Dactylioceras*, *Porpoceras*, *Fuciniceras*, *Protogrammoceras*, *Polyplectus*, &c., and an entirely new sphenodiscoid and involute ammonite with a simplified *Staufenia*-like suture-line, which is the subject of the present paper. *Pseudopygaster*, a new type of irregular echinoid, described by Prof. H. L. Hawkins* in 1922, is based on two specimens from the same assemblage, but the remainder of the ammonites consists of types well known from the Apennines and from Sicily, and, at present, need not be considered in detail.

(b) DIAGNOSIS.

Whorls platygyral (whorl-height=54 per cent. of diameter), subleptogyral (thickness=25 per cent.), perangustumbilicate (width of umbilicus=4 per cent.). Whorl-section sphenodiscid, with periphery extremely acute, but sides gently convex, and greatest thickness near rounded umbilical border. Sides (of internal cast) perfectly smooth. Suture-lines degenerate, with very low saddles and irregularly bifid first lateral lobe; about 42 to the whorl. Length of body-chamber and aperture unknown. The holotype includes only a small portion of the body-chamber, there being eight more septal edges (partly corroded) after the three shown in the figure.

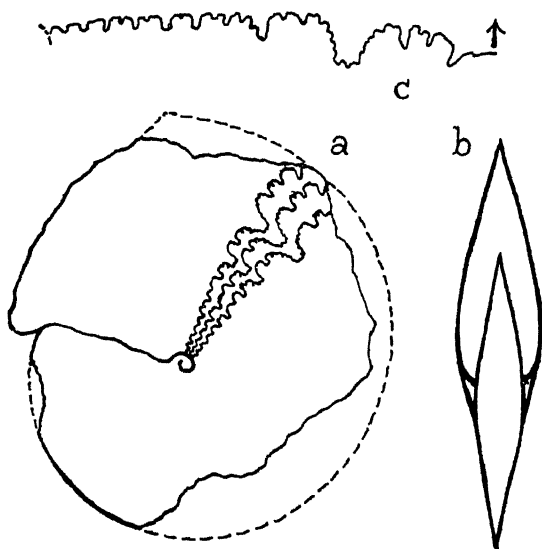
(c) AFFINITIES AND AGE.

Oxycones—that is, involute and discoidal shells with a sharp periphery—were developed in many ammonite stocks between the Lower Lias and the Cretaceous, and generally represent end-forms, showing loss of ornamentation, reduction of the suture-line, or both. The present genus, no doubt, is a similar development of the Harpoceratids (subfamily Hildoceratinæ), that is of a discoidal genus like *Polyplectus*, Buckman†, involving not only

* "Morphological Studies on the Echinoidea Holoetypoides and their Allies.—XII. *Pseudopygaster*, a new Type of the Echinoidea Exocyclia from the Middle Lias of Persia," *Geol. Mag.* vol. lix. 1922, pp. 213–22.

† "Inferior Oolite Ammonites," *Monogr. Pal. Soc.* pt. iv. (1890), p. 214, Suppl. (1904), p. lvii.

loss of the sickle-ribbing, but degeneration of the suture-line, which, however, retains its eight lateral and auxiliary lobes. *Polyplectus* itself is represented in the Baluchistan fauna by a form close to the type-species, *P. discoides* (Zieten) *, and its varieties, but with a more falcate radial line than the examples figured by Buckman and d'Orbigny † and with the periphery contracted,



Sphenarptes hawkinsi, gen. et sp. n.

(Upper ?) Lias, Kelat, Baluchistan. Holotype, with outline whorl-section, natural size, and suture-line, enlarged $\times 2$.

so as to resemble a true keel. The genus *Polyplectus* had been defined by Buckman as closely connected with *Harpoceras*, the absence of a septicarina being perhaps due to degeneration. In *Sphenarptes* the periphery has become as sharp as a knife-edge, and the umbilicus has closed and lost its steep wall; but while the degenerate suture-line still shows the general plan and the individual elements of that of *Polyplectus*, all ribbing has been lost.

* 'Versteinerungen Wurttembergs,' 1830, pl. xvi. fig. 1.

† Pal. Française, Terr. Jurass. vol. i. 1845, p. 356, pl. cxv.

Hudlestonia Buckman *, 1891, a reduced (Upper Toarcian) derivative of *Phlyseogrammoceras* Buckman (subfamily Grammoceratinæ) is less closely comparable to *Sphenarpites* than *Staufenia* Pompeckj, 1906, which has a somewhat similar suture-line and discoidal shape †, but a distinct umbilical wall. It has been correctly described as a descendant of *Leioceras* (subfamily Leioceratinæ), and is of later (Lower Bajocian) age. The Toarcian genus *Paroniceras* Bonarelli, 1893, which includes some slenderer and more discoidal species ‡ than the well-known genotype, *P. sternale* v. Buch sp., is another smooth and suturally reduced member of the Hildoceratinæ, i. e., of the stock that also gave rise to *Frechiella*, but it differs considerably from *Sphenarpites* in most characters. It is interesting, however, to note that four species of *Paroniceras* have been described by Monestier § from the Upper Toarcian zone of *Polyplectus discoides*, which seems to point to an Upper Liassic age for the form here described. But it is probable that the Baluchistan fauna above referred to also includes Middle Liassic elements, or at least ammonites (e. g., *Fucinicerus* and *Protogrammoceras*) much lower in the Toarcian than the European beds with *Polyplectus*; and it must not be forgotten that the range of the last genus itself remains uncertain ||.

Moreover, there are Domerian fore-runners of *Harpoceras* (s.s.) that may have given rise to both *Polyplectus* and *Sphenarpites* independently, e. g., involute types like *Argutarpites* Buckman, 1923 (= *Platyharpites* Buckman, 1927 = *Protogrammoceras* Fucini, 1921, *pars* ¶) and *Lio-*

* "Inferior Oolite Ammonites," Monogr. Pal. Soc. pt. v. (1891), p. 225.

† See, e. g., Quenstedt, 'Ammoniten des Schwabischen Jura,' vol. ii. 1886, pl. lvii. fig. 2 (*Amm. discus densiscriptus*).

‡ E. g., *P. buckmani* Bonarelli in Renz, "Vergleiche zwischen dem südschweizerischen, appenninischen und westgriechischen Jura," Verh. naturf. Ges. Basel, vol. xxxiv. 1923, pl. xii. figs. 4, 4 a, b.

§ "Ammonites rares ou peu connues et Ammonites nouvelles du Toarcien supérieur du S.E. d'Aveyron," Mém. Soc. géol. France, Pal. vol. xxiii. fasc. 2, 1921, p. 8.

|| See Moister, "Zur Kenntnis der Ammonitenfauna des portugiesischen Lias," Zeit. Deutsch. Geol. Ges. vol. lxxv. (1914), p. 573.

¶ 'Fossili domeriani dei dintorni di Taormina,' pt. ii. Pal. Italica, vol. xxvii. pls. iii., iv. *Bassaniceras* Fucini, 1920 (*ibid.* vol. xxix.-xxx. p. 63), is a synonym of *Protogrammoceras* Spath, 1913, emend. 1919 ("Notes on Ammonites.—Pt. IV.," Geol. Mag. dec. 6, vol. vi., April 1919, p. 174).

ceratoides Spath, 1919 (= *Præleioceras* Fucini, 1929). In England a few of these early forms of *Harpoceras* occur in the Marlstone (*spinatum* zone), but the only two Hildoceratids in the *margaritatus* zone are *Seguenziceras* (*algonianum-nitescens* group) and *Leptaleoceras* (*leptum-pseudoradians* group). The former is found together with *Amaltheus clevelandicus* (Young & Bird), the Yorkshire counterpart of the Dorset *A. stokesi* (J. Sowerby), and is therefore of lower *margaritatus* age. The second is found chiefly in the *pseudoradians* (so-called Eype nodule) band of Dorset, about 120 feet above the Three Tiers, or nearly 160 feet up in the *margaritatus* zone. It also occurs in some undefined "marlstone or associated beds" inland (Somerset, Gloucestershire), but has not been found farther north, where only *Seguenziceras* seems to occur. Unfortunately, the exact horizon of nearly all the members of the prolific Mediterranean Hildoceratid faunas remains to be established, so that the Toarcian age of the new genus here described is by no means proved.

LXIX.—*Note on the Habitat of Neotrephes usingeri China* (*Hemiptera*, *Helotrephidæ*). By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History).

THE following information was received from Mr. Fritz Plaumann too late for inclusion in the paper on this species in last month's issue of the 'Annals' (pp 527-538).

Mr. Plaumann writes as follows:—"This bug I have found only in a little mountain stream called 'Wasserfall,' which is devoid of vegetation and very rapid. The bottom is very rocky and full of stones. The bugs live in holes in the rocky bottom which are filled with soil and covered with a thin layer of mud. They are very rare and local. To every one or two kilometres there is only one hole, in which live two or three specimens. The bug appears to live on the soil from these holes. This region is situated in the primæval forest of the River Uruguay and is very mountainous. The latitude and longitude are 27° 11' south and 52° 23' west. Up to now I have found the bug only in this stream."

LXX.—*Eine neue Calliphorine-Art (Dipt.), die Termiten angreift.* Von N. BARANOV, Entomologe des Institutes für Hygiene in Zagreb, Jugoslavien.

Aus dem Imperial Institute of Entomology in London erhielt ich zusammen mit anderem Material drei Exemplare einer kleinen Calliphorine aus Cawnpore, India (per P. B. Richards). Im Begleitbrief schreibt Herr Direktor Sir Guy A. K. Marshall Folgendes darüber: "There are three specimens of a Calliphorid predacious on termites in India about which I shall be specially interested to learn. It looks as if they might belong to a new genus."

Das Studium dieser drei kleinen Fliegen hat mir sehr viel Vergnügen bereitet aber auch viel Sorge durch ihre unklare systematische Stellung. Ohne Zweifel gehört diese Fliege einer neuen Gattung an, wie dies schon Herr Direktor Marshall angenommen hat; jedoch aus welcher Verwandtschaft? Ich will sie nun vorläufig in die Townsend'sche Tribe Bengaliini einreihen, doch wäre es viel besser für diese Art eine besondere Tribe zu schaffen.

TERMITOLCEMUS, gen. nov.

Gattungstyp: *T. marshalli*, sp. n.

Hinterkopf gewölbt, stark entwickelt, in Profil betrachtet breit. Augen klein und nackt, beim ♂ alle Ommatidien gleich gross. Stirn (♂♀) breit, ohne wohlentwickelte prokline Frontoorbitalborsten. Stirnstrieme nackt. Frontalborsten steigen nur bis zur Fühlerborste herab. Fühler oberhalb des Augenmitteniveaus inseriert, Fühlerborste lang, pubescent. Clypeus sehr breit, eingesunken. Facialien und Parafacialien schmal. Vibrissen am Mundrande. Epistoma scharf nach vorne gebogen, jedoch sehr kurz. Backen breit. Rüssel dick und kurz mit stark verbreitertem Haustellum. Taster sehr gross, abgeplattet. Vibrissal- und Antennalachse gleich lang, ihre Länge beträgt $\frac{2}{3}$ der Kopfhöhe. Hypopleural- und Mesopleuralborsten gut entwickelt. Pteropleuralborsten nur haarfein. Propleuren in der Mitte, Prosternum und "postalar wall" nackt. Squama nackt. Metathorakalstigma nicht besonders gross. Postscutellum nur schwach entwickelt. 1. und 5. Radialader

weit hinauf beborstet; 1. Hinterrandzelle an der Flügelspitze mündend. Abdomen des ♀ breit und abgeplattet; alle Sternite frei liegend und Bauchmembran etwas sichtbar. Makrochäten auf Körper und Beinen gut entwickelt. Lamellen des 5. Sternites beim ♂ sehr gross. Hypopygium des ♂ mit sehr kompliziert gebautem Phallus (kein *Calliphora*-Typus!) und sehr grossem Spinus ditillatorius.

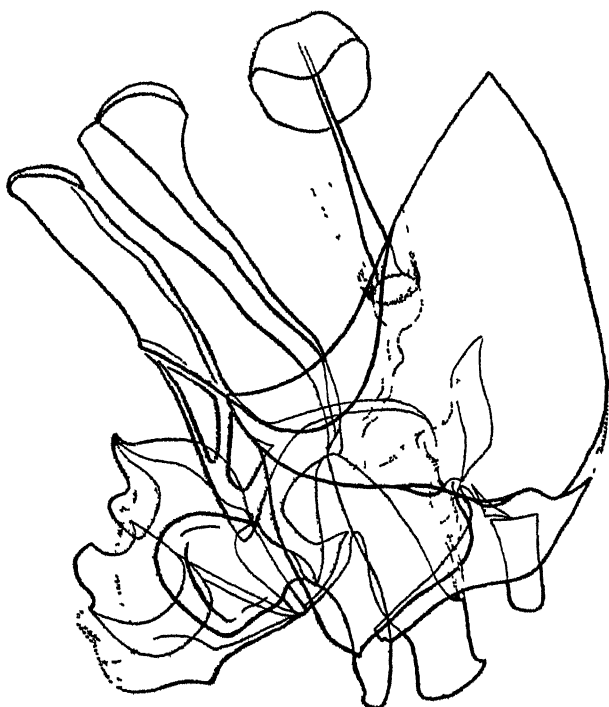
Diese Gattung gehört nach den Tabellen im Townsend'schen Manual of Myiology II, zur Superfamilie Muscoidea, Familie Rhinüda, Tribe Bengaliini. In der Gattungs-Bestimmungstabelle gibt es jedoch für diese Gattung keine entsprechende Stelle; sie liesse sich in der Tabelle (auf S. 150) in Punkt 14, vor *Elephantolæmus*, Austen einreihen und zwar wie folgt: Arista oben und unten pubescent; Hinterkopf im Profil breit, stark gewölbt; vor der Naht nur 1 präsuturale Akrostichalborste.

Termitolæmus marshalli, sp. n.

♂♀. Kleine hellbraune Fliege mit schwarzbrauner Zeichnung, breitem, hinten abgestutztem Abdomen beim ♀, durchsichtigen, kaum gebräunten Flügeln, auffallend grossen, plattgedrückten Tastern und stark entwickeltem Hinterkopf.—Kopf von vorne betrachtet nur wenig breiter als hoch; da die Vibrissen sehr hoch oberhalb des Kopfunterrandes (welcher von Taster und Rüssel verdeckt ist) stehen und man auf den ersten Blick nur den sehr breiten Clypeus und die weit von einander stehenden Augen sieht, hat man den Eindruck als ob der Kopf viel breiter als hoch wäre. Kopf im Profil fast um ein Drittel höher als breit (die Fühler nicht mitgerechnet); Hinterkopf im Profil ebenso breit wie die Augen. Bei zurückgezogenem Rüssel sind die Taster soweit vorgestreckt wie die Augen breit sind. Der abgeplattete, sichtbare Teil der Taster halb so breit wie die Augen. Vibrissen am Mundrande inseriert, dessen Niveau mit dem des Augenunterrandes zusammen fällt. Von oben betrachtet ist der Kopf quer-elliptisch; die hintere Seite ist stärker gewölbt als die vordere (orale). Thorax des ♂ ungefähr so breit wie der Kopf, der des ♀ bedeutend breiter. Schulterbeulen gross. Abdomen des ♂ ebenso breit wie der Thorax, das des ♀ viel breiter. Beine und Flügel normal.—Stirnbreite

am Scheitel betragt das Doppelte der Augenbreite. Stirnstrieme matt-hellbraun und von den Orbiten, welche etwas glanzender, jedoch nur unmerklich heller gefarbt sind, nur schwach abgegrenzt. Ozellendreieck schwarzbraun, gross; Ocellarborsten nach vorne und aussen gerichtet. Das schwarzbraune Ozellendreieck bildet einen Teil der Kopfzeichnung, dieselbe besteht aus drei

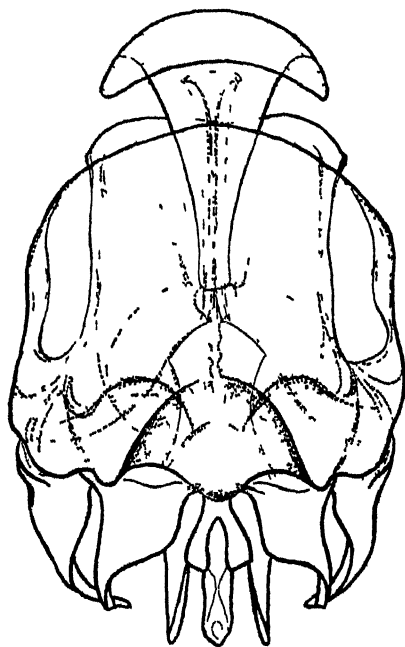
Fig 1.



Hypopygium von *Termitolæmus marshalli*, ♂, gen. nov., sp. n.,
von der Seite gesehen.

schwarzbraunen Striemen, deren mittlere durch das schwarzbraun gefarbte Ozellendreieck gebildet wird; die beiden Seitenstriemen beginnen auf dem hinteren Teil der Orbiten, verlaufen auf dem Cerebrale und bilden beim ♂ einen breit-hufeisenförmigen Bogen in dessen Zentrum das Ozellendreieck steht, während beim ♀ die beiden Seitenstriemen zu keinem Bogen

geschlossen sind. Hinter den Postozellarborsten 2 Postvertikalborsten. Die Okzipitalcilien bilden eine Reihe locker stehender Borstchen und auch der Hinterkopf trägt nur wenige schwarze Borstchen, jedoch keine Behaarung. Innere und aussere Vertikalborsten bei beiden Geschlechtern vorhanden. Auf den Orbiten 1 transversale Frontoorbitalborste und 2 gekreuzte Frontalborsten. Mit den Frontalborsten alternierend stehen



Hypopygium von *Termitolamachus marshalli*, ♂, gen. nov., sp. n.,
von hinten gesehen.

viel kleinere Borsten. Auch auf Orbiten und Wangen befinden sich solche kleine Borsten; eine von diesen (auf den Orbiten) ist nach vorne gebogen (♂♀). Die Frontalborsten steigen nur bis zur Fühlerwurzel herab. Der Clypeus ist sehr tief eingesunken und die schmalen Facialien fallen daher sehr steil gegen den Clypeus ab. Die Höhe des Clypeus beträgt nur um ein Weniges mehr als dessen untere Breite. Epistoma sehr breit

und kurz und scharf nach vorne abstehend. Unter dem Epistoma bemerkt man den viel schmäleren Anteclypeus, welcher jedoch nicht vorspringt und im Profil nicht bemerkbar ist. Die Fühler kurz und breit; das 2. Glied mit einer tiefen Längskerbe, so dass es wie in zwei Lappen gespalten erscheint; der innere Lappen trägt an seiner Vorderseite 3 Borsten: die obere und untere sind nach vorne gerichtet, die mittlere nach aussen (seitwärts); der äussere (seitliche) Lappen an seinem unteren Rande mit einer Börstchenreihe. Das 3. Glied schwarzbraun und $1\frac{1}{2}$ -2 mal so lang wie das zweite. Fühlerborste lang, nur an der Basis verdickt, der ganzen Länge nach pubescent, jedoch die Härchen weit auseinander stehend. Rüssel hellbraun, mit verbreitertem, glänzendem Haustellum. Taster ebenso gefärbt, nur am Ende schwarzbraun; die apikale Hälfte des verbreiterten Teiles mit starken, schwarzen Borsten. Die Backen fast so hoch wie die Augen, mit wenigen, schwarzen Borsten.—Thorax mit dunklerem Rücken und drei schwarzbraunen Längsstriemen beim ♀, welche beim ♂ einen einzigen schwarzbraunen Fleck bilden. Ausserdem sind auch beim ♂ die Schulterbeulen dunkler. Schildchen schwarzbraun, mit hellbrauner Spitze oder auch mit hellbrauner Längsstrieme. Beborstung des Thorax besteht aus Makrochäten und längeren Borsten, bei denen es manchmal ganz unklar ist, ob es Makrochäten oder gewöhnliche Borsten sind. Akrostichalborsten: 1 präsuturale und 1 präscutellare; Dorso-zentralborsten: 2+3; Intraalarborsten: 0+2; Supraalarborsten: 2; Posthumeralborsten: 1; Präsuturalborsten: 1.—Scutellum mit langen Basal- und Angularborsten, 1 kürzeren Lateralborste und 1 Präbasalborste; die Apikalborsten sind haarfein oder ganz unentwickelt. Dorsalborsten vorhanden. Sternopleuralborsten 1 (2)-1. Von den Mesopleuralborsten sind nur zwei stärker entwickelt, die übrigen sind schwach ausgeprägt. Pteropleuralborsten nur als feine Borsten vorhanden. 1 Stigmatikalborste, welche schräg nach oben gebogen ist und 1 (2) Propleuralborste. Metathoraxstigma mit Börstchen auf dem "Fächer." Flügelschüppchen viel kürzer als das Thoraxschüppchen, welches länglich und auf der Oberseite nackt ist.—Flügel: Costa reicht bis zur Flügelspitze, wo auch die 1. Hinterrandzelle schmal offen mündet.

1. und 5. Radialader auf der Flügeloberseite in ihrem ganzen Verlauf beborstet. Auch auf der Flügelunterseite sind diese Adern mit Borstchen besetzt, besonders im Apikalteil. Remigium oben und unten nackt. Beugungsstelle der Medialader breit abgerundet. Hintere Querader befindet sich ungefähr in der Mitte zwischen der kleinen Querader und der Beugungsstelle.—Beine kurz. Vorder-schienen vorn mit je 1 Borste am Ende des ersten und zweiten Drittels und mit 2 Apikalborsten; hinten mit 1 Borste am Ende des zweiten Drittels und 1 Apikalborste; innen mit Apikalborste. Mittelschienen mit 2 Borsten aussen vorn, 1 Innenborste und 5 (6) Borsten am Ende. Hinterschenkel innen vorn im Apikaldrittel mit 4 langen Borsten. Hinterschienen mit längeren und mehr haarartigen Borsten im Vergleich zu denen der Vorder- und Mittelschienen. Besonders lang ist die Borste, welche vorne an der Spitze steht. Beim ♂ ist sie ungefähr so lang wie die Tarsenglieder 1 und 2 zusammen genommen. Klauen und Pulvillen kurz; beim ♂ kaum länger als beim ♀ und bei beiden Geschlechtern viel kürzer als das letzte Tarsenglied.—Abdomen hellbraun mit dunkler Zeichnung an der Basis der Tergite. Diese besteht beim ♀ aus je drei Flecken auf dem 2., 3., 4. und 5. Tergit, wovon der mittlere Fleck etwas länglicher und grösser ist als die beiden seitlichen, beim ♂ dagegen fließen die Flecke zusammen und bilden dunkle Basalbinden. Ventrale Seite des Abdomens ohne dunkle Zeichnung. Alle Sternite freiliegend und die Bauchmembran etwas sichtbar. (1.+) 2. Tergit ist beim ♀ so lang wie das 3. und 4. zusammen genommen, beim ♂ etwas kürzer. Das 6. Tergit ist von oben gesehen beim ♂ und ♀ sichtbar. Abdomen mit Randmakrochäten auf den Tergiten 3, 4 und 5 und mit Diskalborsten auf den Tergiten 4 und 5; beim ♂ befinden sich die lateralen Diskalborsten schon auf dem 3. Tergit; ausserdem ist die ganze hintere Abdominalhälfte lang behaart und die nicht starken Makrochäten sind unter dieser Behaarung schwer zu erkennen.

INDIA: Cawnpore, U.P., 1 ♂, 2 ♀♀, predacious on termite workers, 3. ii. 1935 (*H. N. Sharma*—per P. B. Richards).

Der holotypus ist das männliche Exemplar im British Museum in London.

INDEX to VOL. XVII.

- ABACETUS**, new species of, 314.
Æolothrips, new species of, 495.
Africa, Thysanoptera from, 493.
African bees of the subfamily Anthidiinæ, 31, 600.
 — species of Teleasinae, 114, 161.
Afrostelis, new species of, 346.
Aleurobius farinæ, hypopial stage, 546.
Amblypelta, new species of, from the British Solomon Islands, 324.
Ammonite genus, new, from Baluchistan, 641.
Amphekes, gen. et sp. n., 332, 333.
Amphibians from British New Guinea, 66.
Anaphothrips, new species of, 500.
Anchastus, new species of, 375.
Andrewes, H. E., on Oriental Carabidæ, 307.
Andrewsiella, gen. et sp. n., 593, 594.
Anglo-Egyptian Sudan, Tridactylidæ and Gryllidæ from, 539.
Angopora, gen. et sp. n., 18.
Anthidiellum, new species of, 45, 603.
Anthidium, new species of, 36-42.
Aphthona, new species of, 250.
Arabia, Capsidæ from, 95.
Arctic species of Molpadia, 452.
Arctornis, new species of, 330, 331.
Arrow, C. J., on the beetles belonging to the Lamellicorn genus Chiron, 150.
Artace, new species of, 53-56.
Ascarid, new, from a bat, 360.
Asilidæ of Australia, 161.
Asura, new species of, 488-490.
Asymphylodora, new species of, 319.
Atænius, new species of, 414-425.
Audiothrips, new species of, 493.
Aulacophora, new species of, 253.
Australian Asilidæ, 161.
Ayrshire coal-mine, house mice in an, 553.
Badistor, new species of, 312.
Bagnall, R. S.: notes on Protura, 210.
Baranov, N., weitere Beiträge zur Kenntnis der parasitären Raupenfliegen von den Salomonen und Neubritannien, 97; ein neue Calliphorino-Art, 646.
Barclay, E. N., on the roe-deer of European Turkey, 404.
Barnes, H. F., note on Cecidomyidæ, 272.
Barygenis, gen. et sp. n., 73, 74.
Baylis, H. A., on some parasitic worms from the British Cameroons, 257; on a new Ascarid from a bat, 360; on a new species of Notoctylus from the water-rail, 474; on the Nematode genus Rondonia Travassos, 606.
Bees, descriptions and records of, 24, 346, 477.
 —, new and little-known African, 31, 600.
Beetles, Elaterid, from Melanesia, 368.
 — of the Lamellicorn genus Chiron, 150.
Bibliographical Notice: A Manual of the common Invertebrate Animals exclusive of Insects (H. S. Pratt), 160.

- Borg, F., on a remarkable Cladoceran, 290.
- British Cameroons, parasitic worms from the, 257.
- New Guinea reptiles and amphibians, 66.
- Solomon Islands, *Amblyopelta* from the, 324.
- Brown, James Moikle, on some Collembola from Lapland, 610.
- Bryant, G. E., on insects of the New Hebrides, 242.
- Bularchius, gen. et sp. n., 639, 640.
- Burton, M., on sponges from South Africa, with descriptions of new species, 141; on sponges from South Africa, with descriptions of new species, 141.
- Capsidar, a new genus and species of, infesting coffee in Kenya, 326.
- Carabidae, Oriental, 307.
- Cecidomyiidae, notes on, 272.
- Cercocebus, new species of, 638.
- Chaetoxorista, new species of, 101.
- Cheumatopsycho, new species of, 436.
- Chilo, new fish from, 491.
- Chimarra, new species of, 448-450.
- China, W. E., on a new species of Mecidea from Arabia, 95; on a new genus and species of Capsidae infesting coffee in Kenya, 326; on the first genus and species of Helotrophidae from the New World, 527; on the habitat of Neotrophes usingori, 645.
- Chionæma, new species of, 485-488.
- Chiron, new species of, 152.
- Chlaminus, new species of, 313.
- Chlanius, new species of, 311.
- Chopard, L., on a small collection of Tridactylidae and Gryllidae from Anglo-Egyptian Sudan made by Mr. H. B. Johnston, 539.
- Christmas Island Homiptera, 577.
- Chrysosarcophaga, new species of, 102.
- Cladoceran, a remarkable, 290.
- Clark, H. L., and Deichmann, E., on *Psoliteucumis* Heding and its allies, 564.
- Claviglis, new species of, 465.
- Clivina, new species of, 308.
- Clupea, new species of, 491.
- Coccotrypes, new species of, 632.
- Cockerell, T. D. A., descriptions and records of bees, 24, 346, 477.
- Collembola from Lapland, 610.
- Collenotto, C. L., on a collection of Lymantriidae from North Yunnan, 329.
- Colliuris, new species of, 315.
- Cowley, J., on the *Disparoneura*-complex, 509.
- Cox, L. R., on a fossiliferous Upper Triassic shale from Pahang, Federated Malay States, 213.
- Craniodicticus, new species of, 635.
- Crepidodora, new species of, 251.
- Crypturgus, new species of, 627.
- Cumacea, natural history of certain sand dwelling, 377.
- Cylapofulvius, new species of, 587.
- Cylindrotomicus, new species of, 633.
- Dasychira, new species of, 338-343.
- Dasynoura, new species of, 273.
- Deichmann, Elisabeth, on the Arctic species of *Molpadia*, 452.
- , and Clark, H. L., on *Psoliteucumis* Heding and its allies, 564.
- Dolphacodes, new species of, 595.
- Demotina, new species of, 245.
- Dioxypterus, new species of, 369.
- Dipseudopsis, new species of, 438, 439.
- Disparoneura-complex, the, 509.
- Drymobatoides, gen. et sp. n., 397.
- Dyschirius, new species of, 309.
- Ecnomus, new species of, 441, 442.
- Eggers, Hans: neue Borkenkäfer aus Indien, 626.
- Elton, C., on house mice in a coal-mine in Ayrshire, 553.
- English chalk, *Tomognathus* from the, 304.
- Environment, controlling effect of, upon the corallum in *Favosites*, 1.
- Ernoporos, new species of, 629.
- Erycia, new species of, 99, 112, 113.
- Erythroneura, new species of, 600.
- Euglyphis, new species of, 56-65, 192-209.
- Euphaea, new species of, 147.
- Euproctis, new species of, 333-337.
- European Turkey, roe-deer of, 404.
- Eutachina, new species of, 100, 107, 108.
- Favosites, effect of environment upon the corallum in, 1.
- Febra, new species of, 247.
- Foxon, G. E. H., on the natural history of certain sand-dwelling Cumacea, 377.
- Franklinothrips, new species of, 496.

- Gloveria, new species of, 47.
 Grammatodon, new species of, 214.
 Griffin, F., on the dates of publication of Motschulsky (V. de), 'Etudes entomologiques,' I.-XI., 1853-1862, 256.
 Grove, A. J., a mechanical investigation into the effectual action of the caudal fin of some aquatic Chordates, 280.
 Gryllidæ from Anglo-Egyptian Sudan, 539.
 Gryllomimus, gen. nov., 541.
 Hardy, G. H., on the Asilidæ of Australia, 161.
 Hayman, R. W., on a new subspecies of Mesembriomys hirsutus from Melville Island, 366.
 Heliothrips, new species of, 497.
 Helotrephidæ, first genus and species of, from the New World, 527.
 Hemerobiidæ, new African, 153.
 Hemiptera of Christmas Island, 577.
 Heriades, new species of 347-356.
 Hertlein, L. G.: the dates of publication of "C. H. Küster and W. Kobelt's monograph of Spondylus und Pecten" in vol. 7, pt. 2, of the 'Systematisches Conchylien-Cabinet,' 158.
 Hesperapis, new species of, 482.
 Hinton, H. E., on new species of Atenius allied to A. cribrithorax, 413; Lepiceridæ, a new name for the Cyathoceridæ—Lepicerinus, a new name for the Scotytid genus Lepicerus, 472.
 Hippotragus, new species of, 640.
 Honesia, new species of, 216.
 Homilia, new species of, 429, 432.
 Homeogryllus, new species of, 544.
 Hoplogryon, new species of, 127-140, 161-183.
 Hopwood, A. Tindell, on new and little-known fossil mammals from the Pleistocene of Kenya and Tanganyika, 636.
 House mice in a coal-mine in Ayrshire, 553.
 Hymenoptera, new parasitic, from Africa, 558.
 Hypanthidium, new species of, 601.
 Hyperdiplosis, new species of, 275.
 Hypopial stage of Aleurobius farinæ Koch, 546.
 Indian freshwater fish, rare parasite from an, 319.
 insects of the New Hebrides, 242.
 isomeconemism, gen. nov., 514.
 Izzard, R. J., on the Hemiptera of Christmas Island, 577.
 Jacot, A. P., on undescribed moss-mites from Mauritius, 393.
 Jary, S. G., on the hypopial stage of Aleurobius farinæ Koch, 546.
 Javan race of the Oriental yellow-throated martin, 403.
 Jones, O. A., on the controlling effect of environment upon the corallum in Favosites, with a revision of some massive species on this basis, 1.
 Kenya, Capsidæ from, 326.
 —, fossil mammals from, 636.
 Kiambura, gen. et sp. n., 326, 328.
 Kimmins, D. E., on a new species of Euphæa, 147; on two new African Hemerobiidæ, 153; on new species of Nusalala, 568.
 Kleine, R., über die von Miss Cheesman auf den Neu-Hebriden gesammelten Bronthiden (Coleoptera), 93.
 Kuster and Kobelt's monograph of Spondylus and Pecten, 158.
 Laccocoris, new species of, 590.
 Lapland Collembola, 610.
 Lasiocampidæ, new species of, from neotropical countries, 47, 192.
 Lawrencoppia, gen. et sp. n., 395.
 Lololopisma, new species of, 87.
 Lepiceridæ, new name, 472.
 Lepicerinus, new name, 473.
 Lestremia, new species of, 279.
 Lever, R. J. A. W., on a new species of Amblyopelta from the British Solomon Islands, 324.
 Licyllus, new species of, 248.
 Limphysothrips, new species of, 501.
 Lissodendoryx, new species of, 143, 144.
 Lithurgus, new species of, 358.
 Lygosoma, new species of, 89.
 Lygus, new species of, 585, 586.
 Lymantria, new species of, 344, 345.
 Lymantriidæ from North Yunnan, 329.
 Macrogyron, gen. et spp. n., 185-190.
 Mammals, fossil, from Kenya and Tanganyika, 636.
 — from Angola, 464.
 Manobia, new species of, 249.
 Marten, Oriental yellow-throated, 403.

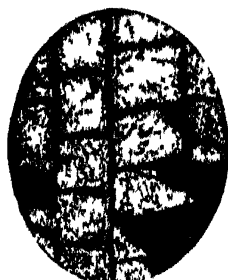
- Mauritius, undescribed mossmites from, 393.
- Mavromoustakis, G. A., on new and little-known African bees of the subfamily Anthidiinae, 31, 600.
- Mecidea, new species of, 95, 96.
- Melanosia, beetles from, 368.
- Mesembriomys, new, from Melville Island, 366.
- Microlestes, new species of, 317.
- Microphanurus, new species of, 558.
- Miltochrista, new species of, 490.
- Miogryllus, new species of, 540.
- Modiolus, new species of, 215.
- Molpadia, Arctic species of, 452.
- Monolepta, new species of, 251.
- Morgania, new species of, 31.
- Mosely, M. E., on new African Trichoptera, 429.
- Mossmites from Mauritius, 393.
- Motschulsky's 'Études entomologiques,' 256.
- Moulton, D., on Thysanoptera from Africa, 493.
- Mugil capito from Lake Qarun, Egypt, 405.
- Muir-Wood, Helen M., on the Liassic brachiopod genera Orthoidea and Orthotoma, 221.
- Natural history of certain Cumacea, 377.
- Neotrepes, gen. et sp. n., 527, 532.
- usingeri, habitat of, 645.
- Neotropical countries, new species of Lasiocampidae from, 47, 192.
- Nesohaltica, new species of, 252.
- New Hebrides, insects of the, 242.
- New World Helotrophidae, 527.
- Nixon, G. E. J., on the African species of Teleasinae, 114, 161; on new parasitic Hymenoptera from Africa, 558.
- Norman, J. R., on a new fish of the genus Clupea from Chiloe, 491.
- Notiobiella, new species of, 153, 156.
- Notocotylus, new species of, 475.
- Nusalala, new species of, 570, 572.
- navási, new name, 570.
- Nyctimystes, new species of, 78-83.
- Nysius, new species of, 580, 581.
- Oecetis aganda, nom. nov., 429.
- Oriental Carabidae, 307.
- Orthoidea and Orthotoma, on, 221.
- Orthotomidae, fam. nov., 224.
- Orton, J. H., on the rate of growth of Sacculina carcini Thompson in Carcinus maenas (Pennant), 617.
- Pahang, a fossiliferous Upper Triassic shale from, 213.
- Parafidelia, new species of, 358.
- Parasite, rare, from an Indian freshwater fish, 319.
- Parasitic Hymenoptera from Africa, 558.
- Paratricycloa, new species of, 103.
- Parker, H. W., on reptiles and amphibians from the mountains of British New Guinea, 66.
- Phorocera, new species of, 109.
- Phorocerosoma, new species of, 99.
- Plagiodora, new species of, 246.
- Platerycia, gen. et sp. n., 110, 111.
- Platyтарus, new species of, 318.
- Pleistocene of Kenya and Tanganyika, fossil mammals from the, 636.
- Pocock, R. I., on the Javan race of the Oriental yellow-throated martin, 403.
- Pœcilomelitta, new species of, 478-480.
- Protura, notes on, 210.
- Pseudanaphothrips, new species of, 498.
- Psoliceumis Hedling and its allies, 564.
- Pycnophthalma, new species of, 242.
- Qarun Lake, Mugil capito from, 405.
- Reptiles from British New Guinea, 66.
- Rhaphidophylus, new species of, 145.
- Rhyparida, new species of, 244.
- Roe-deer of European Turkey, 404.
- Rondonia, the Nematode genus, 606.
- Rothschild, Lord, on a female of Troides victorise regis with male coloration, 306; on new species and subspecies of Zygaenosa, 483; on new species of Chionasema, Asura, and Miltochrista, 485.
- Sacculina carcini, rate of growth, 617.
- St. Leger, Jane, on mammals from Angola, including a new species of Claviglis and a new race of Zelotomys, 464.
- Schaus, W., on new species of Lasiocampidae from neotropical countries, 47, 192.
- Schizotrachelus, new species of, 94.
- Scrapta, new species of, 30.
- Scraptes, new species of, 481.
- Setaria, new species of, 267.

- Shale, Upper Triassic, from Pahang, 213.
- Siagona, new species of, 307.
- South African sponges, 141.
- Spath, L. F., on a new Ammonite genus (*Sphenarmites*) from the Lias of Baluchistan, 641.
- Sphenarmites, new Ammonite genus, 641.
- Sphenomerus, new species of, 371.
- Sponges from South Africa, 141.
- Srivastava, Har Dayal, on a rare parasite of the family Monorchiidae from an Indian freshwater fish, 319.
- Stephanoderes, new species of, 627, 628.
- Stephodiplosis, new species of, 276.
- Syphacia, new species of, 258.
- Systropha, new species of, 477.
- Tachys, new species of, 310, 311.
- Taniethrips, new species of, 502-508.
- Tanganyika, fossil mammals from, 636.
- Tedania, new species of, 145.
- Telcasinae, the African species of, 114, 161.
- Telenomus, new species of, 563, 564.
- Teleostean fish from the English Chalk, 304.
- Termitolæmus, gen. et sp. n., 646, 647.
- Terrazetes, new species of, 400.
- Thamnurgides, new species of, 630, 631.
- Thaumatosoma, new species of, 482.
- Theileriana, new species of, 262.
- Thysanoptera from Africa, 493.
- Titya, new species of, 52.
- Tolyto, new species of, 48-52.
- Tomognathus from the English chalk, 304.
- Toxocara, new species of, 360.
- Triaxodes, new species of, 434.
- Trichoptera, new African, 429.
- Tridactylidae from Anglo-Egyptian Sudan, 539.
- Trinorus, new species of, 116-121.
- Troides victorie regis, female, with male coloration, 306.
- Udetaliodes, new species of, 393.
- Upper Triassic shale from Pahang, 213.
- Water-Rail, new species of *Noto-cotylus* from the, 474.
- Webbia, new species of, 634.
- Wimpeny, R. S., on the ova and larvæ of *Mugil capito* from Lake Qarun, Egypt, 405.
- Woodward, Sir Arthur Smith, on *Tomognathus*, a Teleostean fish from the English chalk, 304.
- Worms, parasitic, from the British Cameroons, 257.
- Xestocophalus, new species of, 598.
- Xyloborus, new species of, 632.
- Zelotomys, new race of, 464.
- Zenillia, new species of, 104.
- Zuphium, new species of, 317.
- Zwaluwonburg, R. H. van, new records and new species of Elaterid beetles from Molanesia, 368.
- Zygænosia, new species and sub-species of, 483-485.

END OF THE SEVENTEENTH VOLUME.



1



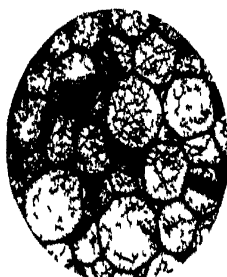
2



3



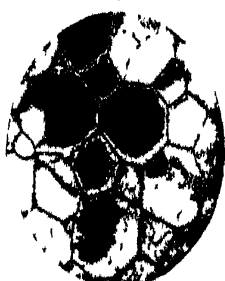
4



5



6



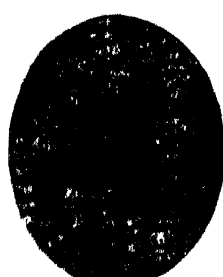
7



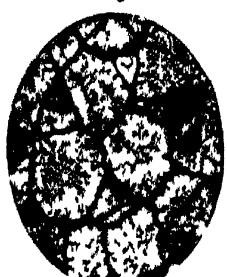
8



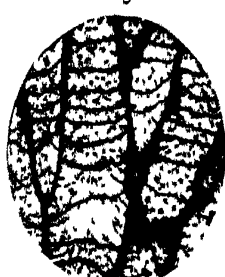
9



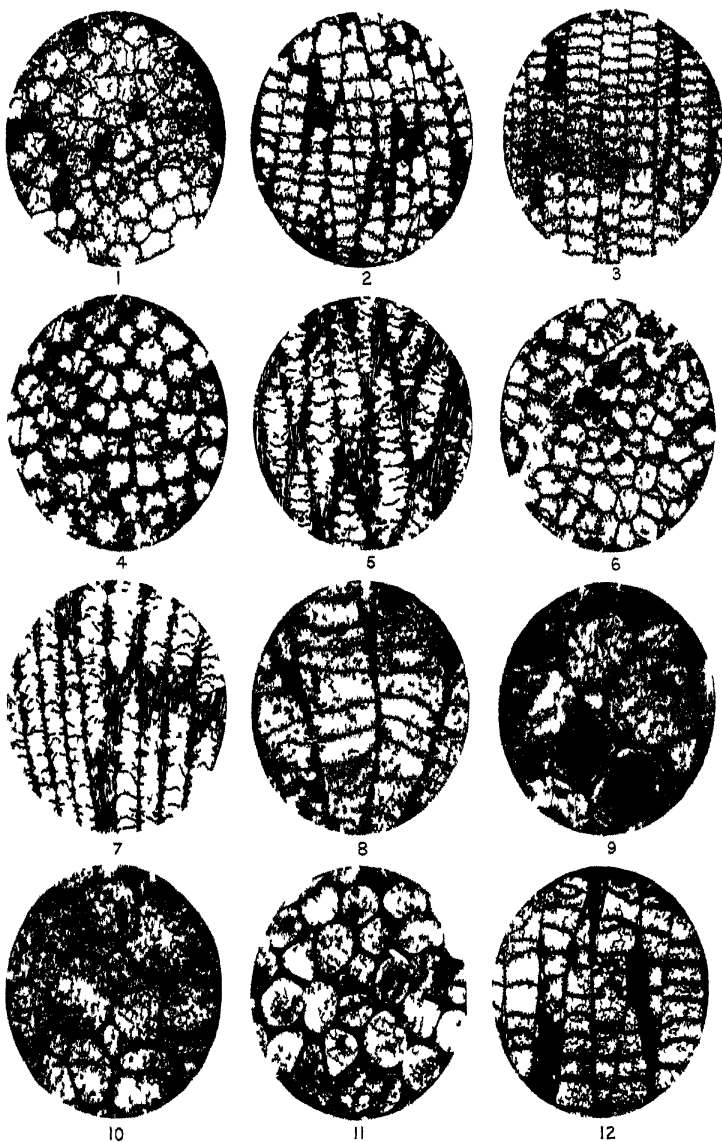
10



11



12



FAVOSITES ASPER d'Orb, F. GOLDFUSSI d'Orb,
F. BASALTICUS (Goldfuss) and ANGOPORA HISINGERI gen et sp nov



ANGOPORA HISINGER gen et sp nov



1



2



5



3



4



6



7



8



9



10



11



12



13



14



15



16



17



18



19



20

Cox photo



21



22



23

FIG. 2



FIG. 3



FIG. 6.

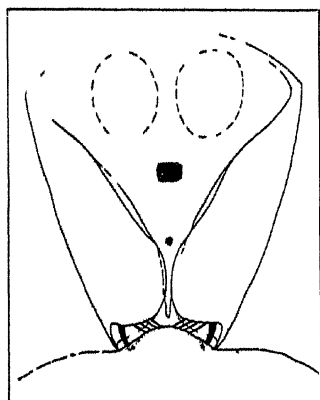
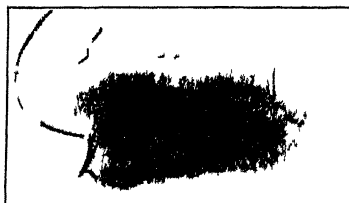
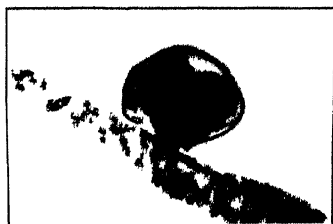
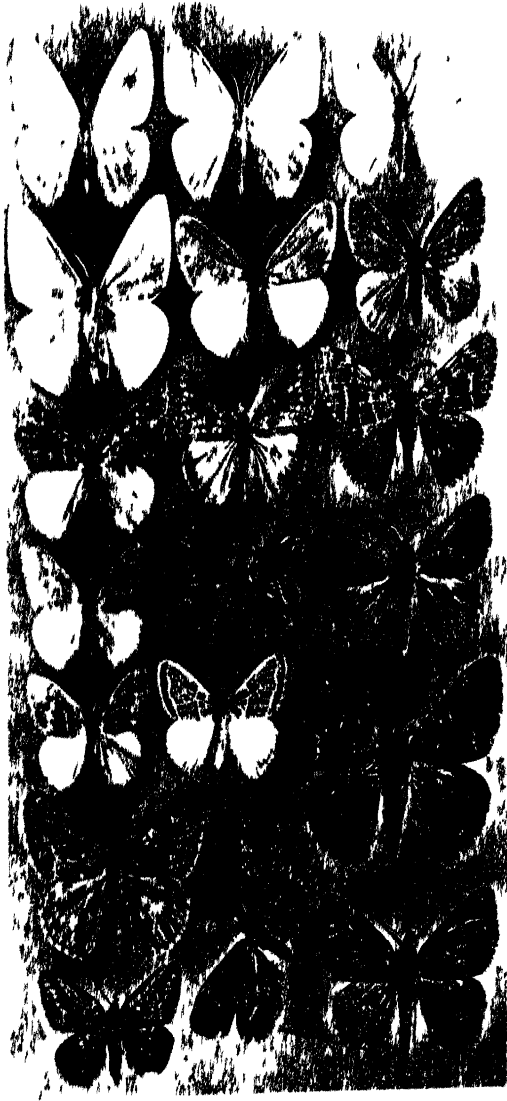


FIG. 4





TOMOGNATHUS MORDAX



IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue.	Date of issue.	Date of issue.
11.6.54		
21-3-61		
31 66		
11/10/91		